To my dear friend
Dr. Levin.

[illegible]

FIG. 1.—The facial expression of the normal, healthy baby.

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SIMPLIFIED INFANT FEEDING

WITH EIGHTY ILLUSTRATIVE CASES

BY

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WITH 14 ILLUSTRATIONS

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PREFACE TO THE THIRD EDITION

As Infant Feeding progresses and newer things come along, they prove a distinct aid in treating difficult feeding cases, and it is necessary to include these newer developments. This the author has endeavored to do in rewriting at this time. On the other hand, the routine feedings that were described in the first edition, are still as useful to the author, and it may be said that the original plan as suggested in the first edition, has seen little change.

The treatment of diarrhœa has been entirely rewritten and further simplified, and a chapter on the newer aspects of rickets and scurvy has been added to the book. Acidified milk, the use of gelatine in infant feeding, goat's milk, synthetic milks now becoming so numerous, coeliac disease, vitamines, calcium caseinate, karo, dehydration, all have been described, necessitating enlargement of the volume.

Although it has been a book for the practitioner and contains facts rather than theories, it was considered advisable to discuss in this edition the theory of Infant Feeding where its direct application to practice would be helpful.

Roger H. Dennett.

125 East 39th Street, New York, N. Y.

PREFACE TO THE SECOND EDITION

In rewriting this book for the second edition, it is gratifying to find that the method described in the first edition, written five years ago, has stood the test of time. It is gratifying because, up to six or seven years ago, the subject of infant feeding had undergone so many and such radical changes. The usefulness of boiled milk, which at that time was scorned by many, is now almost universally accepted by the pediatricians of this country, and the simple dilutions have come to stay.

Although the method itself has not been changed, there have been new and helpful additions to our knowledge of infant feeding as we expect and hope there will be for years to come. It has been attempted to bring this book up to date by including in it these newer things in so far as they have proved useful to the author. There is new matter on Dry Milk, Acidosis, Salts of Milk and the Hypertonic Infant. The chapters on Diarrhœa have been extensively revised.

For the chapter on Acidosis, the author is indebted to Dr. Marshall C. Pease; for the chapter on Salts of Milk, to Dr. Henry I. Bowditch and Dr. A. W. Bosworth, of the Boston Floating Hospital.

The book was never meant to be a review of the literature of infant feeding, for there are a number of excellent books of that type. It was written to help the general practitioner, particularly the post-graduate student, to successfully feed his babies as they occur in his practice.

Roger H. Dennett.

125 East 39th Street, New York, N. Y.
January, 1920.

PREFACE TO THE FIRST EDITION

Extensive experience in teaching post-graduate students the subject of infant feeding has shown the need of something concrete in the form of a book that will tell the busy practitioner just how to feed the different babies with whom he comes in contact day after day.

There has been so much written upon the theory of infant feeding that the general practitioner is lost in its mazes, since the theories are constantly changing and eminent pediatricians differ so widely in their ideas upon the subject.

That is the reason that "theory" has been left out of this book as much as it has been possible to do so, using facts and rules where they can be made to apply.

The book that tells in detail just how to feed an infant is of much more assistance to a physician than one which deals in generalities. There seems to be much objection to the words "method" and "system" in describing infant feeding. It is very popular to say that "every case is a law unto itself." Such a statement tells nothing and is, moreover, not true. In every other branch of medicine, we have a definite method of procedure, and while it is true that there are individual peculiarities of infants, they may be classified to a certain extent, at least, as the author has undertaken to do in this work.

Dr. Abraham Jacobi in taking issue with the statement that to speak of a "method" of infant feeding is taking a distinct step backward, said, "It *is* possible to be guided by the rule. Not every case needs to be fed from the individual standpoint from the beginning. The general rule might be applied at first, and only when the individual does not develop properly under the rule may the physician show his

shrewdness in meeting the special requirements of the individual."

The chief fact remains that most excellent results have been obtained in following out the system described in this book.

The author wishes to acknowledge his indebtedness to Dr. Marshall C. Pease for his kindly criticism and helpfulness in the preparation of this book.

Roger H. Dennett.

125 East 39th Street, New York, N. Y.

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CHAPTER I

SYNOPSIS OF TEXT

SOME POINTS ON INFANTS IN GENERAL WITH SPECIAL REFERENCE TO BOTTLE-FED BABIES

HISTORY TAKING (page 22)

The following points in the history must always be ascertained:

(1) Feeding history of previous children.
(2) How long breast-fed.
(3) Food previously taken.
(4) Number of feedings. Intervals and quantity of food taken.
(5) The bowels.
  - (a) How long have they been in the present condition?
  - (b) Number of stools?
  - (c) Color?
  - (d) Consistency?
  - (e) Presence of mucus?
  - (f) Curds?
  - (g) Blood?
  - (h) Use of cathartics?

(6) Vomiting.
  - (a) Duration.
  - (b) Quantity.

(c) The time (before or after a feeding, or continuous).
(d) Character (projectile?).

(7) Appetite.
(a) Is all the food taken?
(b) Is any of the food thrown away?
(c) Is the baby satisfied?

(8) Sleep.
(a) Morning.
(b) Afternoon.
(c) Night.

PHYSICAL EXAMINATION

(1) Weight: Normal infants gain from six to eight ounces a week under six months of age, three to four ounces a week over that age. The birth weight is doubled in six months, trebled in a year.
(a) Birth weight.
(b) Lowest weight since birth.
(c) Present weight.
(d) Gain or loss each week.

(2) Color: Pallor is seen in difficult feeding cases resulting in anæmia:
(a) Fat babies over six months of age, incorrectly fed (condensed milk).
(b) Prolonged indigestion.
(c) Atrophy (marasmus).

(3) Skin (wrinkled, inelastic skin of bad import): Roughness, scaling, furunculosis, intertrigo, prickly heat and eczema seen in difficult feeding cases.

(4) Development and nutrition.
(a) Fat.
(b) Well nourished.
(c) Moderately well nourished.
(d) Poorly nourished.
(e) Emaciated.
(f) Atrophic (dried up).

(g) Poor musculature.
(h) Undersized (small in stature; small for its age).

(5) Temperature.
(6) Mouth.
(a) Stomatitis.
(b) Red mouth (beefy tongue).
(c) Coated tongue.
(d) Teething.

(7) Facial expression.
(8) Heart and lungs.
(9) Abdomen.
(a) Distention.
(b) Sunken abdomen.
(c) Loss of abdominal tone.
(d) Enlarged spleen and liver, abnormal masses, fluid.

(10) Evidences of rickets.

Head:
(a) Abnormally large head.
(b) Abnormally large fontanel.
(c) Delayed closure of sutures and fontanel.
(d) Square box-shaped head.
(e) Bald spot on the back of the head.

Chest:
(a) Beading.
(b) Pigeon breast.
(c) Flaring of the ribs.
(d) Harrison's groove.
(e) Soft ribs sinking in on inspiration.

Extremities:
Enlarged epiphyses at the wrists and ankles.

DIRECTIONS FOR MAKING BABIES' FOODS

(1) *Write* all directions.
(2) Write the number of ounces of milk, water, sugar and other ingredients.

(3) Make up the twenty-four-hour amount of food at the same time each day.
(4) Divide the total quantity into as many bottles as there are to be feedings in twenty-four hours.
(5) State the approximate quantity at each feeding, the intervals and the exact time at which each feeding should come.

BOTTLES, NIPPLES AND UTENSILS FOR MAKING THE FOOD

(1) Direct the mother to purchase the proper utensils: 8 or 10 bottles, 3 or 4 nipples, measuring glass, wire bottle rack, bottle brush.
(2) Give directions for the care of the bottle, nipples, and food.

THREE ESSENTIAL REQUIREMENTS FOR INFANTS' FOOD

(1) It should contain the proper elements to maintain nutrition and allow for growth.
(2) It should be digestible.
(3) It should contain the proper quantity of food, which is best estimated by caloric standards.

THE PROPER ELEMENTS IN THE FOOD

(Proteins, fats, sugars, mineral salts, water and vitamines)

Breast milk contains from 3 to 4 per cent. fat, 6 to 7 per cent. sugar, 1 to 2 per cent. protein. A food of cow's milk made to approximate these percentages is not easily digested. The fats, sugars and proteins are interchangeable to a limited extent.

(1) The proteins.

Some protein is essential for cell construction and to replace the nitrogenous waste. Cow's milk diluted one-third gives 1 per cent. protein in the food, diluted half and half it gives 1½ per cent. protein in the food, approximating the percentage of protein in breast milk.

(2) The fats.

Fats save nitrogenous waste, supply heat and energy and add to the body weight by storing up fat. Average cow's milk diluted three times gives 1⅓ per cent. fat, diluted twice gives 2 per cent. Since breast milk contains from 3 to 4 per cent. fat, the deficiency in cow's milk is made up with sugar.

(3) The sugars and other carbohydrates.

Sugar supplies heat and energy and replaces fat waste in the body. The carbohydrates used in infant feeding are cane sugar, milk sugar, malt sugar, and starchy foods in the form of gruels, one of which must be added to supply the deficiency of sugar in cow's milk, since when diluted three times it contains only 1⅓ per cent. of sugar and diluted half and half gives but 2 per cent.

(4) The mineral salts.

Salts are furnished in abundance in both human and cow's milk.

(5) The water.

The food of all young mammals contains from 80 per cent. to 90 per cent. water.

(6) The vitamines.

At present there are four: "Fat Soluble A," "Water Soluble B," "Water Soluble C," "Fat Soluble D."

DIGESTIBILITY OF THE FOOD

Simple milk, sugar and water mixtures are most easily digested.

(1) The proteins.

The proteins are made up of ¾ casein (curds) and ¼ albuminous protein (whey). The curds are no longer considered as indigestible as formerly.

The methods of making the proteins more digestible are:

(a) Boiling milk.
(b) Acidifying milk (Lactic Acid Milk, Sour Milk).
(c) Gelatinizing milk (colloidal action of gelatin).

Boiling the milk is usually all that is necessary to make the proteins digestible.

(2) The fats.

A mixture made of cow's milk containing 4 per cent. fat, thus imitating the percentage of fat in breast milk, is not easily digested by the average infant. Cow's milk diluted one-third gives $1\frac{1}{3}$ per cent. fat, diluted half and half gives 2 per cent. fat. This amount of fat is digested with ease by the average infant. It is occasionally necessary to use skimmed milk in severe cases of indigestion caused by fat.

(3) The sugar.

Sugar is the most frequent source of indigestion of any of the elements. It is usually a laxative, though it has not been settled which of the three sugars (cane sugar, milk sugar or malt sugar) is the most laxative.

The author advises the use of:

(a) Cane sugar for older infants and those with no intestinal or gastric indigestion.

(b) Malt sugar for infants having had much intestinal trouble. (Dextri-maltose, Karo corn syrup.)

(c) Milk sugar not at all.

(d) Malt soup extract and wheat flour in those cases that do not do well upon any other kind of sugar.

(e) No sugar whatever (temporarily) in infants with diarrhœa or severe vomiting.

The quantity of sugar.

A WELL *infant under ten pounds* in weight should receive *one* ounce of sugar in twenty-four hours, a WELL *infant over ten pounds* in weight may have $1\frac{1}{2}$ ounces of sugar in twenty-four hours. This gives in the mixture six or seven per cent. of sugar, the same as in breast milk. Infants with vomiting, diarrhœa or lack of appetite should receive no sugar temporarily.

The rapidity with which the sugar is increased to 1 or $1\frac{1}{2}$ ounces depends upon:

(a) Whether the infant has formerly had sugar or not.

(b) Whether the kind of sugar is being changed or not.

(c) Whether there has previously been any diarrhœa or vomiting and the duration of that diarrhœa or vomiting.

THE PROPER QUANTITY OF FOOD TO SUPPLY THE CALORIC NEEDS

Food may be compared with fuel in a furnace. A furnace requires so many tons of coal to run an engine, an individual infant needs a certain amount of food to use up in heat, energy and growth. A ton of coal represents a definite number of calories, and an ounce of milk or an ounce of sugar represents a definite number of calories, the term used to express food value.

CALORIC VALUE OF INFANTS' FOODS

1 oz. of milk	= 20 calories.
1 oz. of sugar (by weight)	= 120 calories (any kind of sugar).
1 oz. of flour (by weight)	= 100 calories.
1 oz. malt soup extract	= 90 calories.
2 scant tablespoonfuls of malt soup extract	= 1 oz. by weight.
2 level tablespoonfuls of cane sugar	= 1 oz. by weight.
3 level tablespoonfuls of milk sugar	= 1 oz. by weight.
4 level tablespoonfuls of dextri-maltose	= 1 oz. by weight.
4 level tablespoonfuls of flour	= 1 oz. by weight.

(tablespoons to be levelled with a knife)

CALORIC REQUIREMENTS FOR BOTTLE-FED INFANTS

Babies do not all require the same number of calories.

Fat infants over four months of age .... need 40 to 45 cals. per lb. per day.

Average infants under four months of age and moderately thin babies of any age .... need 50 to 55 cals. per lb. per day.

Emaciated infants (varying with the degree of emaciation) .... need 60 to 65 cals. per lb. per day.

To determine the number of calories a baby needs in 24 hours, multiply the weight of the individual infant by the caloric requirements per pound. Example:

An average infant 3 months of age weighing 12 lbs. needs 50 calories per pound. $12 \times 50 = 600$ total caloric requirements in 24 hours.

To determine the amount of milk needed in 24 hours, subtract the caloric value of the sugar (which is a fixed quantity) from the total caloric requirements. Example:

The above infant needs 600 calories, 180 of which (1½ oz. of sugar = 180 calories) are sugar. $600 - 180 = 420$, number of calories of milk needed.

To determine the number of ounces of milk needed in 24 hours, divide the number of calories of milk by 20 (1 oz. milk = 20 calories) $420 \div 20 = 21$.

To determine the quantity of water, subtract the amount of milk from the total 24-hour amount of food that the individual infant can take, trying to make the dilution no stronger than half and half for infants under ten pounds weight, or those who have recently recovered from vomiting or diarrhœa.

To determine the 24-hour quantity of food, multiply the number of feedings by the number of ounces taken at a feeding.

The quantity of food given at each feeding is from one to two ounces more than the number of months of the infant's age, with a maximum of eight ounces and a minimum of three or four ounces, though undersized infants can often take only one ounce for each month of their age.

The number of feedings in twenty-four hours during the first four months is usually seven, best given at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.

After four or five months of age, six feedings in twenty-four hours may be given at 6, 9, 12 A.M., and 3, 6, 10 P.M.

A few undersized and feeble infants under four

months of age may be given ten feedings in twenty-four hours, that is once in two hours at 6, 8, 10 A.M., 12 M., 2, 4, 6, 8, 10 P.M., and 2 A.M.

A ROUGH RULE TO TAKE THE PLACE OF RECKONING CALORIES

The average infant having no digestive disturbances requires in twenty-four hours twice as many ounces of milk as he weighs in pounds, provided he can take 1½ ounces of sugar. This rule is a rough one only. Thin or emaciated infants need more. Fat infants need less.

CONDITIONS UNDER WHICH THE CALORIC REQUIREMENTS SHOULD NOT BE FULFILLED

One of the first principles of caloric feedings is never to fulfil the caloric requirements in the following classes of infants:

(1) In the newborn (for the first two weeks).

(2) Normal infants abruptly weaned from the breast (until their tolerance for food can be gradually increased).

(3) Infants whose previous food has not contained cow's milk (until the milk and sugar can be gradually increased).

(4) Infants who have been overfed (until their digestive apparatus has had a chance to recuperate).

(5) Infants who have been underfed (until their tolerance for food has been gradually increased).

(6) Infants who have diarrhœa or who have recently recovered from diarrhœa (until the stools have become normal and the tolerance for food has been gradually increased).

(7) Infants who have excessive vomiting or have recently recovered from excessive vomiting (until vomiting has stopped and the tolerance for food increased).

(8) Infants with loss of appetite (until all food is greedily taken).

(9) Infants who are partially breast fed (until they are entirely weaned, because it is not known how many calories they are getting from the breast).

DIARRHŒA IN BOTTLE-FED INFANTS

Diarrhœa in bottle-fed infants is more often the result of intestinal indigestion due to incorrect feeding than to bacterial infection.

A routine treatment of a cathartic followed by a period of starvation should not be adopted because in such cases the bowel is usually emptied of its own accord and starvation weakens the infant unnecessarily.

The physician should personally inspect the stools and determine the

1. Duration of the diarrhœa.
2. Number of stools in 24 hours.
3. Size.
4. Color.
5. Consistency.
6. Odor.
7. Reaction.
8. Presence of mucus.
9. Presence of curds.
10. Presence of blood.
11. Whether cathartics have been administered or not.

THE CLASSIFICATION AND DIAGNOSIS OF DIARRHŒA IN BOTTLE-FED INFANTS

INTESTINAL INDIGESTION

(Dyspepsia, Lowered Tolerance for Food)

1. Intestinal indigestion from
   - (a) Fat.
   - (b) Sugar.
   - (c) Protein.
   - (d) Starch.

2. Intestinal indigestion accompanied by....
   - (a) Underfeeding.
   - (b) Overfeeding.
   - (c) Lowered tolerance that cannot be raised by the usual methods above a point where a proper and continuous gain in weight may be made.

INFECTIOUS DIARRHŒA

1. Fermentative diarrhœa (sugar or starch diarrhœa, sugar intoxication).
2. Putrefactive diarrhœa (protein diarrhœa).
3. Mild types of infectious diarrhœa.
4. Dysentery (acute infectious diarrhœa, ileocolitis, intoxication).
5. Parenteral infections.

MISCELLANEOUS

1. Marasmus (lost power of assimilation, decomposition, atrophy).
2. Cœliac disease.
3. Diarrhœa from cathartics.
4. Other organic causes: typhoid, amœbic dysentery, tuberculosis, ulcer, intussusception.

TREATMENT OF DIARRHŒA IN BOTTLE-FED INFANTS

Protein Foods:

- (a) One-third milk and two-thirds water, boiled together, no sugar.
- (b) Protein Milk or Calcium Caseinate mixtures.
- (c) Lactic Acid Milk.

Indications:

(1) Intestinal indigestion from fat. / sugar. / protein. / starch.

(2) Underfeeding, accompanied by intestinal indigestion.

(3) Overfeeding, accompanied by intestinal indigestion.

(4) Mild types of fermentative infectious diarrhœa of short duration.

Carbohydrate Foods:

(a) Barley gruel.

(b) Sugar solutions.

(c) Thick gruels of various kinds, such as cornstarch, arrowroot, farina, etc., fed with spoon. Breadstuffs.

Indications:

(1) Putrefactive diarrhœa.

(2) Overfeeding.

(3) Mild types of infectious diarrhœas.

(4) Dysentery.

(5) Severe infectious diarrhœa in small, young infants (cholera infantum).

(6) Dehydration.

(7) Acidosis.

(8) Infants not improved by a thorough trial of protein foods.

(9) Chronic diarrhœas in children old enough to eat from a spoon.

CONSTIPATION IN BOTTLE-FED INFANTS

Causes and treatment of constipation in the bottle-fed.

(1) Gastric indigestion.

(a) Treatment must be appropriate for the causative factor.

(2) Too much fat.

(a) Eliminate cream or top milk in food; give proper quantities of whole milk, water and sugar mixtures.

(3) Too much sugar.

(a) With constipated infants consuming two ounces or one and a half ounces of sugar in twenty-four hours, reduce the amount to one ounce, strengthening the milk to fulfil the caloric requirements. (The normal amount of sugar for an infant under ten pounds of weight is one ounce in the twenty-four-hour amount. Infants weighing more than ten pounds may have one and one-half ounces. Two ounces is the maximum quantity of sugar to use in twenty-four hours and that only rarely.)

(4) Too little sugar.

(a) Gradually increase the sugar to the proper quantity for the infant's age when constipation is found in infants fed with too little sugar.

(5) Too little or too weak food having little residue.

(a) If too weak dilutions of milk and water are being used, they should be increased.

(b) If any proprietary food without milk is being used it should be stopped and dilutions of milk given, usually one-third milk and two-thirds water at first.

(c) If no sugar has been given, it should be added, a teaspoonful at a time, until the correct amount is given.

(d) If the amount of sugar in the previous food has been correct it may be gradually increased, provided there is no vomiting or lack of appetite.

(6) Excessive vomiting or lack of appetite.

(a) For treatment, see *Vomiting and Lack of Appetite.*

(7) Boiled milk.

(a) When milk has been boiled to remedy diarrhœa or vomiting, the symptoms of which have ceased, it may be given raw.

(b) When vomiting is present, the constipation becomes secondary and a water enema should be administered every day if necessary rather than stop boiling the milk.

(8) Cathartics.

(a) Orange juice (small quantities at first) or scraped raw fruits in infants over six months of age.

(b) If dietetic measures fail, milk of magnesia is the mildest laxative to use.

(9) Habit. Accustom the infant to use the vessel at regular intervals.

(10) Organic lesions.

(a) Fissures may be treated with a stick of silver nitrate once in three or four days.

(b) An abnormally small anus may be gently stretched day by day.

VOMITING

ACUTE VOMITING

Causes:

(1) Acute indigestion.
(2) Infectious gastro-enteritis.
(3) Miscellaneous causes: General infectious diseases such as pneumonia, acute exanthema, etc., peritonitis, intestinal obstruction, nephritis, cerebral vomiting from meningitis, brain tumor, etc., drugs and poisons.

Treatment:

(a) Stop food and water.
(b) Empty the bowels.
(c) Wash out the stomach.
(d) Give sodium bicarbonate by mouth.
(e) Administer sedatives.

HABITUAL VOMITING

Causes:

(1) Errors in the details of administering the food.
 (a) Too rapid feeding.
 (b) Too slow feeding.
 (c) Feeding in a reclining position and leaving the infant to take the bottle alone.
 (d) Not allowing the air (swallowed during the nursing) to be eructated before the feeding is completed by occasionally holding the infant in an upright position.
 (e) Too long a nipple, which gags the infant.
 (f) Tossing the infant about or handling it too soon after feeding.
 (g) Tight belly-band and clothing.

(2) Indigestion from { fat. / sugar. / proteins. / starch.

Treatment:

(a) Feed one-third milk and two-thirds water boiled together, with no sugar or a very small amount of sugar. Gradually increase to half and half and add sugar.

(b) Use boiled skimmed milk without sugar when case is not controlled by treatment (a).

(3) Overfeeding in quantity.

The normal quantity of food given at each feeding should be one or two ounces more than the number of months of the infant's age, with a maximum of 8 oz. and a minimum of 3 or 4 oz., while the undersized infant can take only one ounce for each month of its age.

In infants who are vomiting, the bulk of the food taken at each feeding should be reduced even if it involves giving a stronger food in order to supply the caloric needs.

(4) Hypertonic (symptoms which are cured by atropin):

(1) Vomiting.	(4) Constipation.
(2) Crying.	(5) Cold extremities.
(3) Insomnia.	(6) Underweight.

(5) Organic causes: Pyloric stenosis, dilatation of the stomach, gastroptosis.

LOSS OF APPETITE

Causes:

(1) Wrong feeding or overfeeding.

(2) Limited digestive capacity. (Babies having a narrow margin between their digestive capacity and the amount of food they need to make a gain in weight when properly fed.)

(3) Inanition. (Too weak to take food.)

(4) Sore mouth or throat or some other pathological condition which makes it difficult or painful for the infant to swallow.

(5) Infants who dislike the taste of the food.

Treatment:

(a) Feed one-third milk, two-thirds water, without sugar (one-half milk, one-half water for the older, larger infants).

(b) Lengthen the intervals between feedings for the older, larger infants.

(c) Use a nipple with a very large hole for the weak infants.

(d) Administer strychnia, gr. $^1/_{300}$ to $^1/_{150}$ every six hours, before a feeding.

(e) Change the taste of the food with sugar, saccharine or salt.

(f) Feed by gavage as a last resort.

BREAST-FEEDING

SYMPTOMS INDICATIVE OF SUCCESSFUL BREAST-FEEDING

1. The infant gains six or eight ounces a week the first six months and after that from three to six ounces a week.
2. It falls asleep as soon as fed or while feeding and sleeps twenty hours out of every twenty-four up to the sixth month of age.
3. It does not cry more than one hour a day.
4. It has from one to three normal stools a day and no vomiting or gas.

SYMPTOMS INDICATIVE OF UNSUCCESSFUL BREAST-FEEDING

1. The infant loses in weight, ceases to gain or gains insufficiently.
2. It remains too long at the breast.
3. It cries or frets while nursing.
4. It cries when taken from the breast.
5. It has abnormal stools.
6. It has extreme vomiting which can be definitely attributed to the breast milk. (All the above symptoms are not invariably present.)

CONDITIONS UNDER WHICH BREAST-FEEDINGS SHOULD BE CONTINUED EXCLUSIVELY

1. Where the infant is normal and doing well upon the breast.

2. Where the infant is not doing well and the condition can be accounted for by errors in the management of the mother or infant, or by the health of the mother.

ERRORS TO BE CORRECTED IN THE MANAGEMENT OF THE MOTHER OR INFANT

1. Regulation of the *mother's diet.*
2. Improving, if necessary, the *mother's appetite.*
3. Regulation of the *mother's bowels.*
4. Regulation of other hygienic details, such as *exercise, sleep* and *mental quiet.*
5. Remedying any actual *disease* of the mother, such as anemia, etc.
6. Regulation of *feeding times* and *intervals.*
7. Correcting any errors in the *detail of giving the breast.*
8. Remedying any defects in the *hygienic surroundings or management of the infant.*

BREAST-FED, NEW-BORN INFANTS

After the first two or three days (during which time an infant may be fed every four hours) the three-hour interval should be used, seven feedings in twenty-four hours.

INDIGESTION IN NURSING INFANTS WHO ARE GAINING WELL IN WEIGHT

1. Do not stop breast for indigestion.
2. Diminish the infant's food supply by
   a. Limiting mother's diet:
      (1) Stop large quantities of liquid nourishment between meals.

(2) Stop highly flavored fruits or vegetables, or highly seasoned foods.

(3) Stop alcohol, candy, and rich desserts.

b. Shorten infant's feeding time to five minutes once in three hours, six or seven feedings in twenty-four hours. (Gradually lengthen the feeding times up to the infant's capacity after the colic has ceased.)

INDICATIONS FOR COMPLEMENTING THE BREAST WITH ARTIFICIAL FEEDINGS

(Completing Each Feeding with the Bottle)

1. Where the infant does not gain normally in weight after a thorough trial upon the breast under the best possible conditions.

METHOD OF COMPLEMENTING THE BREAST WITH ARTIFICIAL FEEDINGS

Give five- or ten-minute feeding from the breast, completing each feeding with a bottle. Usually use one-third milk and two-thirds water to start with. Gradually increase to half milk and half water, and if the bowels are constipated, add one-quarter ounce of sugar in the twenty-four-hour mixture, increasing this amount as the weight and condition of the bowels seem to warrant.

INDICATIONS FOR SUPPLEMENTAL FEEDINGS

(Alternating Bottle Feedings with Breast Feedings)

1. Where the infant is being intentionally weaned from the breast.

2. Where the mother is obliged to be away a part of the day.

CONTRA-INDICATIONS FOR BREAST-FEEDING

(The breast must never be discontinued where it is in any way possible to avoid it.)

1. Where the infant has severe prolonged gastric or intestinal indigestion associated with loss in weight or cessation of gain.
2. When at two previous births the mother has been unsuccessful in nursing the infant under the proper conditions and intelligent care.
3. Where the mother has puerperal convulsions.
4. Where the mother is pregnant.
5. Where the mother has some prolonged acute infectious disease as typhoid fever or pneumonia.
6. Where the mother has tuberculosis, epilepsy, nephritis, any malignant disease, anæmia, or where the mother or the infant has contracted syphilis after the infant's birth.

CONDITIONS UNDER WHICH THE BREAST SHOULD BE TEMPORARILY DISCONTINUED

1. In acute illness of the mother.
2. In selected cases, during menstruation.
3. In some cases of acute diarrhœa in the infant.
4. In some cases of acute vomiting in the infant.

WEANING, EIGHT TO TEN MONTHS OF AGE

Wean, if possible, directly to cup and spoon, so that a second weaning from the bottle is not necessary.

Wean gradually by substituting one artificial feeding at a time for the breast feeding.

Foods to give while weaning: cereals, whole milk, crackers, stale bread, baked potato.

DIARRHŒA IN BREAST-FED INFANTS

Usual Causes:

1. Overfeeding.
2. Changes in the breast milk.
3. An acute intestinal indigestion arising from supplementing the breast with other foods.

VOMITING IN BREAST-FED INFANTS

Acute Vomiting.

Cause: Acute indigestion.

Treatment: Temporarily stop all food and water; empty bowels, institute treatment suggested in section on "Vomiting in Bottle-fed Infants."

Habitual Vomiting.

Causes:

1. Errors in details of breast feeding, etc.
2. Too rich milk.
3. Organic causes.

Treatment: Correct errors in detail, shorten feeding time, or treat for organic trouble.

CONSTIPATION IN BREAST-FED INFANTS

Causes:

1. Irregular and too frequent feedings.
2. Constipation of the mother.
3. Insufficient food.
4. Excessive vomiting.
5. Abuse of cathartics.

CHAPTER II

SOME POINTS ON INFANTS IN GENERAL WITH SPECIAL REFERENCE TO BOTTLE-FED BABIES

To attain the greatest measure of success in feeding bottle-fed infants, one must pay attention not only to the minutest details of the infant's life, but also to the most careful carrying out of all directions in connection with it. The author frequently hears the complaint that mothers will not follow the directions given, and he believes that when this is so, the trouble often lies with the physician.

History Taking

It is an art to take a good history. The very fact that a thorough history is taken, showing familiarity with all the details of feeding, inspires confidence. It is almost impossible to get a correct idea of symptoms and existing conditions from the voluntary information of any mother, and it is left for the physician to tactfully obtain from her the information necessary for the successful treatment of his case.

He may begin by getting information as to the number of previous children; how many are living, and how many have died. The history of a number of deaths in the family during the bottle period has a direct bearing upon the prognosis of the individual case, the infant to be treated very probably not having proper resistance nor digestive capacity.

Then comes the question of how long the infant has been breast fed, and with what success. An infant that has had a good start upon the breast, even if it were only for one or two months, will not be as difficult to feed, nor to treat,

when gastro-intestinal disturbances occur, as one who has never had any breast milk. But, on the other hand, a prolonged unsuccessful attempt at giving the breast may have exactly the opposite effect, in weakening the infant and lowering its digestive capacity.

Food Previously Taken.—A knowledge of the composition of the previous food is of the utmost importance in prescribing a new food for an infant. If food containing cow's milk has never been given, it is necessary to guard against giving too large an amount of it at first, and against too rapidly increasing the amount. The same is true of an infant who has never had any sugar.

If a proprietary food has been used, one must know what that proprietary food contains, in order not to repeat the error that has already caused digestive disturbances or malnutrition. To get the important information relating to previous foods, it is generally necessary to ask many questions. To the first question, "What are you feeding your baby?" the answer usually will be, "Cow's milk," or "Barley gruel," or such and such a proprietary food. It is then advisable to say, "Tell me just how you make this food." It is an exceptional mother who will even then explain to you each detail of making the food, and the exact quantity of each ingredient. When told that milk and water are used, the physician must ascertain how many ounces of milk and how many ounces of water, and whether or not they have been boiled together or separately or not at all.

Although it is one of the most important ingredients of the food, in the vast majority of cases the mother neglects to make any mention of the sugar. For this reason, the question must always be asked, "Are you using any sugar, and if so, how much and what kind?"

The Number of Feedings, Intervals, and Quantity of Food Taken.—After having ascertained the kind of food being taken, the next step is to find out the quantity given at each

feeding and the intervals at which the infant is being fed, as well as the number of feedings during the night and day. It is impossible to tell whether an infant is overfed or underfed unless the quantity of food taken during each twenty-four-hour period is known. The quantity of each ingredient may be correct, and yet, if all of the food is not taken, underfeeding is the result. If the infant has been fed irregularly or the quantity has been given by "guess," it is difficult to obtain very exact data. In such cases it is often possible to find out how many bottles an infant is getting a day by reviewing the events of the present day or the previous day from morning until night, and fixing the time of each feeding. The number of feedings, multiplied by the quantity taken at each feeding, will give the total twenty-four-hour amount of food, which should be compared with the quantity that is said to have been made up for the day. By cross-questioning, it is frequently found that all the food that is made up is not being taken by the infant. Again, the amount of food which the mother has described may not be the correct quantity, because she has prepared the food more than once during the day. The question, "What time do you make your food?" will help to make this information more accurate.

The Bowels.—Having ascertained all the details of the composition and quantity of the food, the intervals and number of feedings, it is then well to inquire about the bowels. To the question, "How are the bowels?" very little information is elicited, for the answer will usually be, "All right," or "Very bad," both of which are unreliable for the reason that the mother's opinion may differ from yours. It is therefore well to open the discussion of the condition of the bowels by asking the question, "How many stools does your baby have a day?" after which inquiries as to the color and consistency must be made: whether mucus, curds or blood are seen, and never omitting to ask whether cathartics are

being used or not. The stools should then be carefully inspected. If none have been saved for this purpose, directions should be given to have them saved in the future. (See Stools, page 89.)

Vomiting.—We must now consider the question of vomiting. To the question, "Does your baby vomit?" the answer is almost invariably "Yes." This, too, is probably very unreliable information, as it may mean that only a mouthful is spit up immediately after a feeding, perhaps because of the air swallowed during the nursing. If this is the extent of the vomiting, it should be recorded as none. If it is decided that the vomiting is extensive enough to have a bearing upon the case, care is to be taken to find out the quantity vomited. It is important to find out whether the vomiting occurs immediately after feedings, throughout the intervals, or just before a feeding is due. It is also well to find out whether or not it is projectile in character. (See Vomiting, page 178.)

The Appetite.—The appetite is the next factor to be considered in the history. "Does your baby take all the food given it at each feeding, and if not, how much is left and at how many feedings during the day does this occur?" An infant should readily take all the food offered if the food is a proper one and if all the details of administering it are carefully followed out. A mother will often tell you that the baby is not satisfied with its food. It then becomes necessary to find out whether the infant cries before a feeding is due, or when a feeding is finished, as either may indicate hunger. (See Loss of Appetite, page 200.)

Sleep.—Ascertain next the amount of time spent in sleep during the day and night. Lack of sleep may be indicative either of hunger or of indigestion. During the first weeks of life an infant should sleep almost all day, except when nursing or while being bathed. After three months of age, a healthy infant will sleep at least twenty hours out of the

twenty-four, and beyond six months, sixteen to eighteen hours. It should be wakened for each feeding in order to establish regular habits. As soon as a normal infant is fed, it will fall asleep again, so that it does no harm to awaken it.

The Weight.—The next step is to weigh the infant, for without the exact weight to begin with, it is impossible to feed a sick baby. It is impossible, too, to gauge the required quantity of the various ingredients of the food without the exact weight. The physician who intends to do much work among infants must have an accurate pair of scales in his office. An infant who is not making a normal progress and who is seen in the home must be weighed there and scales must be especially provided for this purpose. If the parents are taught the importance of knowing the baby's weight, they will usually be only too glad to coöperate in the matter of supplying the scales. The dial or spring scales, such as are ordinarily sold for weighing babies, are practically useless, for when the baby kicks, the dial bobs about to such an extent that an accurate reading is almost impossible.

The infant should be weighed naked and the weight accurately recorded. Weekly weighings are advisable.

The normal infant doubles its birth weight in six months, and trebles it in one year. That is, an infant weighing 7½ pounds at birth should weigh 15 pounds at six months of age and 22 pounds at one year. There is an initial loss in weight during the first three to five days after birth which should not be greater than eight ounces. This loss should be regained by the end of the second week. After this, there should be a steady gain of about one ounce a day or from six to eight ounces a week, up to the sixth month of age. This, however, may not always be continuous, more being gained one week and less another. After the sixth month, a gain of four or five ounces a week is all that may be expected.

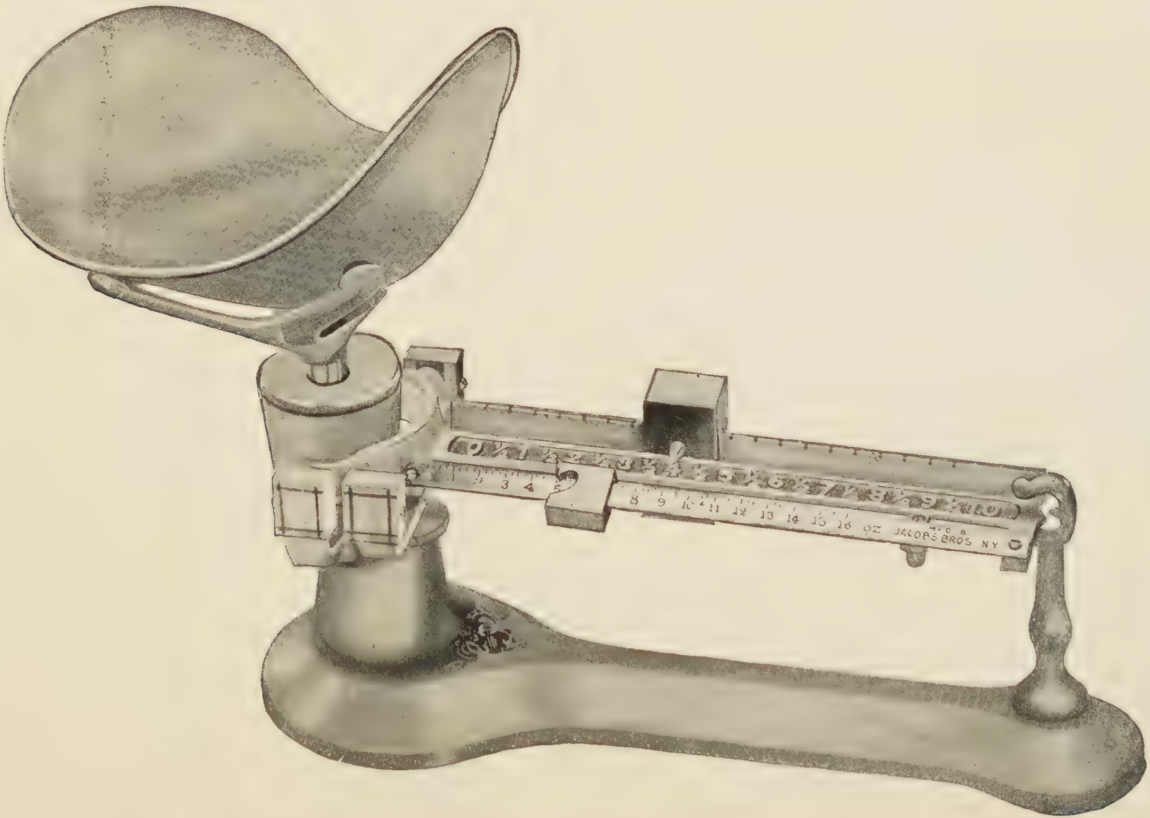


Fig. 2.—Excellent and inexpensive baby scales, made by Jacobs Bros., 78 Warren St., New York City.

It is not advisable and I never allow a mother to weigh her baby every day, as she will usually worry on the days that do not show a gain in the baby's weight.

Physical Examination

Having finished with the infant's history to date, the physician is prepared to begin upon his physical examination. He may observe first, the color.

Color.—Infants that have been difficult to feed and have had much indigestion or have been undernourished over a long period of time are apt to be pale. A marked pallor is almost universally observable in atrophic, emaciated babies (marasmus). Many fat and seemingly well-nourished infants, during the latter half of the first year, are pale, and condensed milk infants are notoriously white and fat.

Skin.—Much valuable information may be gained by a careful inspection of the skin over the entire body. A skin inelastic and wrinkled (so that when one wrinkles it up the wrinkles remain for several seconds before smoothing themselves out again) is characteristic of the emaciated and atrophic infant. This sluggish condition of the skin is almost always of bad import, and indicates that the other organs, particularly those of the gastro-intestinal tract, are probably equally as sluggish.

Lesser degrees of nutritional disturbances are manifested in the skin by a certain roughness and scaling, red papules scattered over the body, and a susceptibility to eczema, intertrigo, furunculosis, or prickly heat. Another significant appearance of the skin is seen in infants who have become rapidly emaciated from a severe enteritis or other acute illness. This condition manifests itself in a different form of wrinkling than that of the atrophic infant, because the fat layer is not entirely gone from underneath the skin, the lack of tone and inelasticity in this case being due to the *sudden* loss of fluids from the body and perhaps, in addi-

tion, to severe toxæmia. This condition of the skin, too, is almost always of bad import.

One of the first manifestations of the improvement in all such cases is the healthy smoothness and glossiness of the skin, which appears as soon as the weight increases and the digestive disturbances are overcome.

Development.—Next comes the infant's development. Infants who have done badly are usually small, often being several inches below the normal; they are usually under weight, as shown by the scales.

The classification that is often used in referring to an infant's condition makes a distinction between *fat, well nourished, moderately well nourished, poorly nourished* or *emaciated.* This is a rough way of expressing the examiner's opinion of the infant's nutrition, and is on the whole a very useful classification. The *moderately well-nourished* infant is one that is a *little below* the normal standard. The *poorly-nourished* infant is thin, while the *emaciated* infant has lost all of the fat layer, its ribs stick out, and the joints are prominent.

The term "atrophy," called by Finkelstein "decomposition," and formerly known as marasmus, applies to the drying up of the whole body, with loss of power to absorb and assimilate food. A typical senile facial expression is characteristic of this latter class of infants.

Poor musculature is a term indicative of a flabby condition of the muscles, which can be readily seen and appreciated on feeling the arms and legs.

Infants who have had digestive disturbances, or have been improperly fed, or who for any reason have not prospered are usually undersized or small in stature. It is not uncommon to see an infant of six or seven months that is only as large as a two-months-old baby should be, or an infant of ten months that is the size of the normal four-months-old baby.

Temperature.—The taking of the temperature is of great

importance and is too often neglected. An emaciated or marasmic infant will frequently run a subnormal temperature, which is strongly indicative of its condition and points definitely to the fact that the infant should not be exposed to sudden changes in the temperature and should be kept warm. Starvation, particularly in new-born and very young infants, will often cause a temperature of 101° or 102° F. The differential diagnosis between an infectious diarrhœa and a bad case of intestinal indigestion often rests upon the fever, a high temperature usually being present in an infectious diarrhœa and no temperature or one of very slight degree in intestinal indigestion (except when acute).

Mouth.—An examination of the mouth is most important. All forms of thrush and stomatitis find a fertile field in cases of malnutrition. A refusal to take food may be due to a sore and inflamed condition of the mouth. An extremely red, irritated appearance of the inside of the mouth and tongue, called a beefy tongue, is often found in subnormal infants and in those having various digestive disturbances, and is indicative of their condition. A coated tongue is just as important a sign in the infant as it is in the adult, yet many physicians who would never think of neglecting to look at the tongue of an adult patient seldom examine the tongues of their feeding cases. A coated tongue is often the first manifestation of indigestion, before vomiting or intestinal indigestion begins, and a clean tongue, in cases where the history of vomiting is given, gives rise to the suspicion that the mother is exaggerating this symptom or that the vomiting is due to some error in administering the food, rather than to indigestion.

Teething.—Teething infants are most difficult to feed, particularly if they have always been artificially fed and if the food has not been properly prepared and administered.

In spite of the difference of opinion regarding the influence of the teething process upon the infant's digestive apparatus, the author believes that digestive disturbances

are more easily acquired at the time of the eruption of the teeth. Diarrhœa is probably not caused directly by the teething process, but infants who have a great deal of local irritation in the gums and a consequent loss of sleep have, therefore, a lowered digestive capacity. The appetite is impaired, and a diarrhœa acquired at this time is difficult to combat.

Facial Expression.—It is well to observe here the infant's facial expression, for in all diseases of infancy much information may be gained in this way. It is often possible to tell at a glance that an infant is having abdominal distress by the characteristic expression of its face. One is able, also, to recognize an infant suffering with severe acute infectious diarrhœa, dysentery and intoxication by the sunken and half-closed eyes, open mouth, and general appearance of stupor. There is also the listless, lifeless expression of the infant who has been underfed for a long period of time and the senile expression of the atrophic infant to be noted.

Heart and Lungs.—The heart and lungs must be examined to make sure that there is no diseased condition of these organs.

Abdomen.—Abdominal distention is a frequent accompaniment of intestinal indigestion, malnutrition, and rickets. Infants that have been improperly fed come to the physician with a marked abdominal distention, and one of the first indications of the infant's improvement under the proper dietetic treatment is a decrease in this distention, provided it is not due to some organic disease of the abdomen. A sunken abdomen is usually an indication of a severe or prolonged diarrhœa, or a long period of underfeeding. The abdominal tone offers valuable information. Upon palpation, the healthy muscular resistance of the abdomen of the normal infant is in great contrast to the soft, doughy feel of the abdomen when nutritional disturbances are present. It is well to become familiar with this peculiar feel in order readily to distinguish the various grades between

A B

Fig. 3.—(*A*) Facial expression of an infant with gastro-enteritis; (*B*) facial expression of infant with atrophy (marasmus).

the two. The greater the loss of abdominal tone, the worse is the prognosis in the individual case. An examination should be made for enlarged spleen and liver, abnormal masses and fluid in order to rule out other abdominal diseases in the final diagnosis.

Evidences of Rickets.—An infant suffering from rickets is difficult to treat. He gains more slowly in weight and strength and has less power to resist intercurrent affections.

An abnormally large head and fontanel, delayed closure of the fontanel or sutures, and bald spots on the back of the head where the brittle hair has been rubbed off are all indicative of rickets.

Beading, which consists of an enlargement at the costochondral articulation of each rib, pigeon-breast, flaring of the ribs, which gives a bell-shaped chest, and Harrison's groove (a depression around the chest at the insertion of the diaphragm) are further evidences of rickets observable in the bones of the chest. In some emaciated, rhachitic infants the ribs are so soft that the chest sinks in instead of expanding at each inspiration.

Directions for Making Babies' Food

Having diagnosed the case and decided upon the exact composition of the food needed and the intervals and time of feeding, the directions should be plainly written for the mother so that she may have them for future reference. By so doing, many mistakes are avoided. The mother may be confused and possibly ill at ease, and consequently by the time she arrives home has forgotten most of the oral directions that have been given her. The writing of such directions takes very little more time than it does to explain them orally, and both may be done at the same time, once the habit is acquired.

The quantity of milk, the quantity of water, the quantity of sugar, whether the milk is to be boiled or not, and the exact method of preparing the food should be stated clearly.

The following printed blank is used by the author and saves much time and annoyance:

Milk .... ounces
Water .... ounces
Sugar .... level tablespoonfuls
Divide evenly into.....bottles.
Feed at , , A.M.; , , P.M. , , A.M.

The above food is enough for twenty-four hours; no more should be made.

Always make the food at the same time each day.

The amount has been carefully calculated and the baby should take it all.

Always use a fresh unopened bottle of milk. Pour the milk into a clean pitcher, pour it back into the bottle to mix the cream through it thoroughly.

Do not boil the food unless directed to do so here.

BOIL: DO NOT BOIL

When the milk is to be boiled it should be done in the following manner: Measure out the required number of ounces of water, put it into a saucepan, and bring it to an active boil. While boiling, pour in the required number of ounces of milk and bring to a boil as rapidly as possible, stirring vigorously all the time so that a scum will not form upon the top. Boil actively for three minutes after it has once come to a boil.

Do not add the sugar until the food is taken off the stove.

The sugar is to be measured with the average sized tablespoon and levelled with a knife.

Pour immediately into clean feeding bottles, using as many bottles as there are to be feedings in twenty-four hours, each bottle to contain the required number of ounces for one feeding when the whole is divided evenly among them. Stop up the bottles with a clean piece of absorbent cotton. Place them in the bottle rack and cool as quickly as possible, in cold running water in the summer time, and out of the window in the winter time. It should take no more than ten minutes to get the bottles very cold. Place directly upon the ice until used. At each feeding-time place a bottle in hot water or in a bottle warmer and heat to blood heat, testing the temperature on your bare forearm. Never heat the bottle before it is time to feed the baby.

Bottle babies over two months of age must always have orange juice. Begin with a teaspoonful once a day, one hour before a feeding. As the baby gets older increase the orange juice a teaspoonful at a time, up to the juice of a half or a whole orange, once a day, an hour before a feeding.

If not directed to boil the milk, boil the water alone, take it off the stove, measure out the proper quantity and add the sugar while it is hot. Allow it to become ice-cold before adding the milk, which should also be ice-cold.

Feed at the same time each day, exactly upon the hours stated above, awakening the baby if asleep, until accustomed to regular hours.

Hold the baby in your lap while feeding, sitting up in the same position as though he were taking the breast. It should take fifteen or twenty min-

utes to take the bottle. If taken quicker than that, a nipple with a smaller hole should be used. Do not keep taking the nipple out of the mouth to lengthen the time of a feeding. If the feeding takes much longer than fifteen minutes, get a nipple with a larger hole. If the baby does not take all the food in twenty minutes, when the hole is large enough, throw the remainder away and wait until the next feeding-time before feeding again.

Immediately after a feeding is taken, scrub the bottle with a bottle brush and soap. Rinse out the soap and put a heaping teaspoonful of borax into the bottle, fill half full of water and shake until the borax is dissolved. Then fill the bottle brimming full of water and allow it to stand until the food is mixed the next morning, when the borax water is poured out, the bottle rinsed and turned upside down to drain while the food is being made. The nipples should be cleaned out immediately with dry borax and placed in half a glass of water with a heaping teaspoonful of borax in it, until used again.

The following utensils should be purchased and kept for the baby's use only:—8 nursing bottles (Walker-Gordon bottles preferred), with small necks and bottoms rounded on the inside. At least three nipples (Davidson's or Anti-Colic). A wire bottle rack holding six or seven bottles. A cheap, blown glass graduate (measuring glass), holding sixteen ounces. A glass funnel which fits nicely into the bottles. A deep saucepan, the bottom of which is no more than six inches in diameter, so that the milk will not boil away too much. An enamel or china pitcher that pours well. A tablespoon, regulation size, the bowl of which is 2⅞ inches long and 1¾ inches wide.

Do not be disturbed if the baby vomits a few mouthfuls after a feeding; even normal breast-fed babies do this.

Do not under any circumstances give castor oil, castoria, milk of magnesia or any other cathartics, unless the baby is suddenly taken acutely ill with a fever. If the bowels do not move at the end of twenty-four hours give an injection of plain water or warm sweet oil, using a baby ball syringe (sometimes called an ear syringe), with a soft rubber tip. When oil is used 1 ounce is sufficient. It should be allowed to stay up two or three hours if possible. When water is used three or four syringefuls may be required to bring about the movement. Constipation is not harmful to bottle-fed babies who have done poorly, but is, in fact, much welcomed, while stools which are too loose are very injurious.

ALWAYS BRING ONE OR TWO STOOLS AT EACH VISIT.

The food for twenty-four hours should be made *once a day,* at the *same time each day,* and as soon as possible after the milk comes in the morning. The milk should never be allowed to stand outside the door where there is an early morning delivery, but should immediately be put upon ice until the food is made. The advantage of making up all the food for the day at the same time is obvious, for, by so doing, all the feedings are uniform in composition. When the food

is made, *the entire amount should be divided equally into the number of feedings required,* one bottle for each feeding prescribed in the twenty-four hours. When this detail is painstakingly carried out, the food is as clean as possible, since it has been put into sterile bottles and nothing has come into contact with it before it is taken. By this means, it is also easier to find out whether all the food is taken, by asking if there is any left over in the bottle after any of the feedings, or if there are any bottles left over in the morning when the new feedings are made up.

Bottles, Niipples and Utensils for Making the Food

The Bottles.—The best bottles are those that are round and cylindrical in shape and have a narrow neck for the attachment of the nipple. A most important requirement of a bottle is that it have no corners on the inside, being rounded both at the bottom and at the top where the neck begins, which enables it to be kept thoroughly clean. Since there should be as many bottles as there are feedings in twenty-four hours, it is best to get a wire bottle rack to hold them when the food is made up for the day.

The following directions should be given the mother: As soon as the baby has taken his feeding, wash out the bottle with soap or washing powder, using a long-handled bottle brush to get it scrupulously clean. Then rinse the soap out with hot water, and put into the bottle a heaping teaspoonful of borax. Some warm water is now poured in and the bottle is vigorously shaken until all the borax is dissolved. It is then filled brimming full of water and allowed to stand full of this strong borax solution (borax is a stronger and better antiseptic than sodium bicarbonate) until the next morning, when the feedings are made up for the day. If each bottle is treated in this way, we have in the morning the whole number perfectly clean and ready to be filled with the day's feedings as soon as the borax solution has been poured out and the bottles rinsed once with clear water. With this

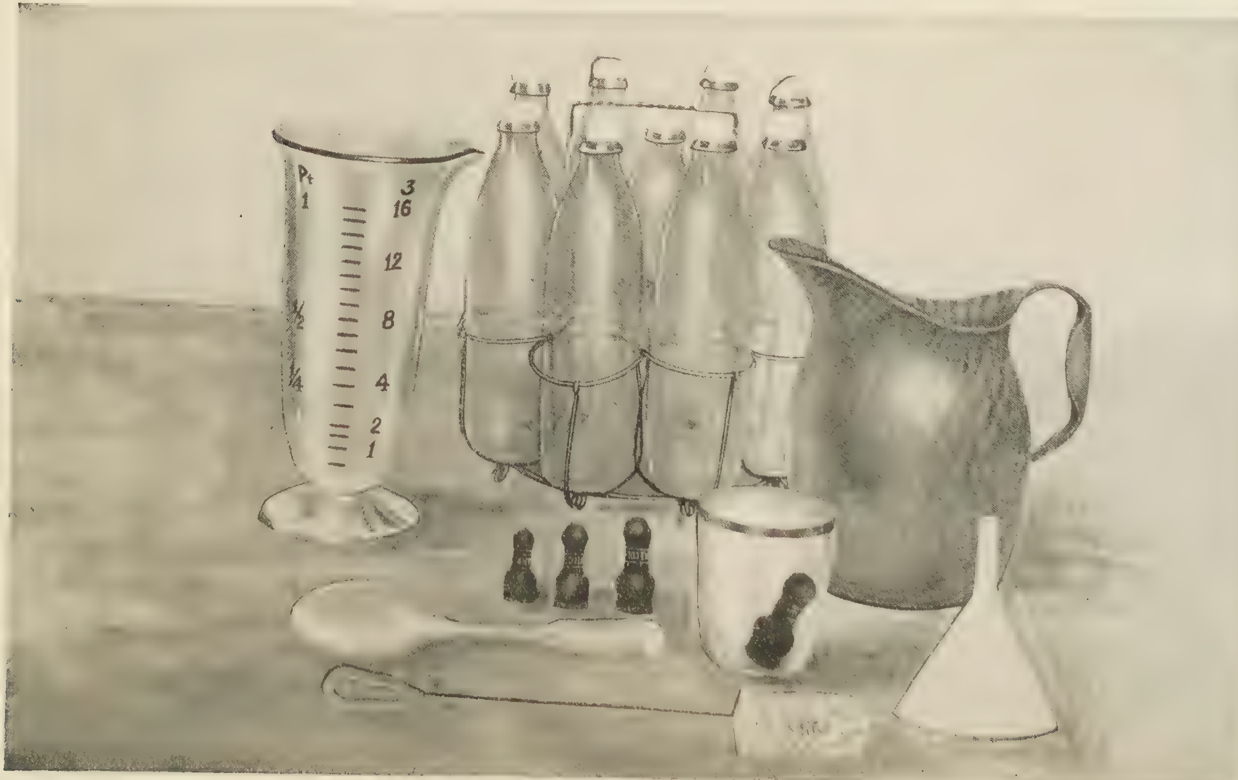


FIG. 4.—The proper paraphernalia for bottle feeding.

method it is unnecessary to boil the bottles each day, which is a great saving of time and trouble. The bottles should never be allowed to stand unclean or filled with plain cold water.

The nipples are also important. For the small baby, a nipple that is not too large nor too long should be selected. Frequently, a long nipple will gag an infant and may be the cause of vomiting the whole feeding just as it is being finished. It is often a very difficult task to get nipples with holes of the correct size. If the baby gets the food too fast, it may cause colic, indigestion or vomiting; therefore, care should be taken in the selection of a nipple with one hole in it which will be small enough so that the feeding cannot be taken in less than twenty minutes. It is well to have two or three nipples on hand. When new, they should be boiled once. As soon as the feeding is taken, the nipple should be filled with dry borax and held under the faucet, being rubbed at the same time between the thumb and fingers. It is then placed in a cup of water containing one heaping teaspoonful of borax. If treated in this way the nipples need not be boiled out after the first day, nor need they be turned inside out when cleaned. Rinse the nipple before using.

The utensils for mixing the food must be kept in a place by themselves and not used for any other purpose. These utensils are not many. A cheap measuring glass, or graduate, holding sixteen ounces and divided into ounces, is a time-saving device which it is well to have; a wide-necked pitcher that pours well and holds two quarts, a glass funnel which does not fit too tightly into the neck of the nursing bottles, a tablespoon (regulation size), a new enamel or aluminum saucepan for boiling the water or food, and a one-quart preserving jar in which to put the gruel or boiled water away until it is cold.

If gruel is used to dilute the milk, it may be made the night before, so that it will be ice-cold before it is added to the milk. In some cases the milk is boiled with the gruel.

We are now ready to prepare the day's feeding. The bottles, one for each feeding throughout the day, are clean and full of borax water from the day before. The bottle rack is placed over the sink and the bottles, one at a time, are placed in it, upside down, to drain. When they are empty, they are then turned right side up in the rack and filled with hot water in order to rinse out the borax, and are again placed upside down to drain and cool while the food is being mixed.

The previously unopened bottle of fresh milk is then poured into the pitcher so that the cream will be mixed evenly through it and then poured back again into the bottle in which it came. The proper amount of milk is now measured in the graduate and poured into the pitcher. Next the sugar is measured with a tablespoon and added to the water in the manner described in the directions to mothers on page 32. If *level* tablespoonfuls are ordered, level each with a knife. A *heaping* tablespoonful means all you can get upon the tablespoon. Stir until the sugar is dissolved when the food is done. Using the funnel, pour into each bottle the amount the baby is to have at each feeding. Stopper the bottles with clean absorbent cotton and put the rack of bottles in the ice chest (directly on the ice, if possible). Wash the utensils and put them away for the following day.

When the feeding time comes, place one of these bottles in a pan of hot water, or in an alcohol bottle heater. The food should be heated to the body temperature when it is fed. It is as inadvisable to have the food too hot as it is to have it too cold. The temperature should be tested by pouring a few drops upon the forearm and *never* by putting the nipple in one's mouth, or touching the finger to the food itself. In this way the food is not contaminated by handling.

In winter it is well to have a woollen bag or knitted cover which just fits the bottle and helps retain the heat during the twenty minutes that the baby is feeding.

CHAPTER III

THE THREE ESSENTIAL REQUIREMENTS FOR INFANTS' FOODS

In prescribing food for any infant, there are three main points for consideration. First, *it should contain the proper elements to maintain nutrition and to allow growth;* second, *it should be digestible;* and, third, *it should contain the proper quantity of food, which is best estimated by caloric standards.*

In the past, many methods of infant feeding have been dependent upon one rather than upon all three of these equally important requirements. For instance, in the early days of the percentage feeding, so much emphasis was placed upon the importance of having the proper *elements* in the food (that is, the correct percentage of fats, sugar and protein, by the use of cream and top milks) that its *digestibility* was neglected. Simple mixtures of cow's milk, water and sugar usually fulfil these three requirements for an infant's food, and it is seldom necessary to use anything else.

Proper Elements in the Food

The elements of food required by the infant to maintain growth and nutrition are, as in adult life, six in number: proteins, fats, carbohydrates, mineral salts, water, and vitamines. The form in which they should be fed to the infant and the relative quantities in which they are demanded are different from those required in adult life.

The ideal bottle food would be one that imitates breast milk and would therefore contain 3 to 4 per cent. of fat, 6 to 7 per cent. of sugar and 1 to 2 per cent. of protein. Such a food, when made of cow's milk, is not well borne except by infants with the strongest digestive capacity, and it is, there-

fore, not practicable to attempt to feed these mixtures to difficult "feeding cases," the kind of cases that the physician is usually called upon to treat. The reason is obvious. The fat, sugar and protein of cow's milk are of a different kind than those of breast milk. They are intended for the digestive apparatus of the calf and not for the infant's stomach, and, since we must use cow's milk for infant feeding, we should give it in as easily digested a form as possible.

Chapin has contributed the most convincing proof that it is impossible to so modify cow's milk as to duplicate mother's milk. He has studied this question from a biological standpoint and finds that the milk of various mammals curdles differently, *i.e.*, cow's and human milk have practically the same chemical composition with varying percentages, but physically they are entirely different. Cow's milk curdles in a tough, leathery mass because 70 per cent. of the digestion of the cow takes place in the stomach and nature provides a milk that will conform with this condition. Human milk curdles in a soft, flocculent curd because only 30 per cent. of the infant's digestion takes place in the stomach. In short, Chapin has shown that nature in producing the milk of the various mammals provided it in correspondingly varied forms, so that each young mammal would receive a food that would develop its particular digestive tract in accordance with future needs.

Fats, sugar, and protein are interchangeable to a limited extent. It is not claimed, however, that the fats, sugars, and proteins are interchangeable to such an extent that an infant will thrive throughout the feeding period upon a food in which any one of these elements is entirely lacking.

The Proteins.—That some protein is an absolute necessity goes without saying, and it has yet to be proven that the large quantities of protein given in whole milk mixtures do harm or, as has been said by some authorities, are an added

tax to the digestion. Proteins are the only kind of food that are capable of replacing the continuous, nitrogenous waste of the cells of the body upon the condition of which the digestion and assimilation of the other elements of the food depend. The protein is furnished by the casein and albuminoids found in both cow's milk and human milk.

Since cow's milk contains over 3 per cent. protein, and breast milk has only 1 per cent. or 2 per cent., this element of the food can be made to closely approach breast milk as far as the percentages are concerned by diluting the milk one-third or one-half. One-third milk will give 1 per cent. protein, one-half milk will give 1½ per cent. protein, whereas three-fourths milk and one-fourth water will give a mixture containing 2¼ per cent. protein. It must be clearly understood that the kind of protein found in cow's milk is very different from that found in breast milk. Both on account of the fat and on account of the protein, it is usually best to give no stronger dilutions than one-half milk and one-half water to infants under three or four months of age or to infants who have had much digestive disturbance.

Proteins are a group of amino acids linked together, there being as many as eighteen in an almost indefinite number of combinations to form the protein molecule. The proteins of milk and meat can be almost quantitatively converted into body proteins. Pepsin and other digestive juices convert the protein through several stages to amino acids where they are finally absorbed as such into the portal circulation. Enough protein must be given, for an infant not only to provide for repair and wear and tear, but to allow for body growth. About three to three and a half gms. of cow's milk protein per kilo of body weight has been found ample for the average infant for twenty-four hours, that is, one and one-third oz. of cow's milk per pound of body weight as a minimum. Any excess of protein within rea-

son above the requirement is converted into carbohydrate and utilized as a source of energy. Insufficient protein causes slow growth, poor musculature, anæmia and lowered resistance.

The Fats.—Theoretically, the infant should have 4 per cent. of fat in its food, because breast milk contains this amount. But from the practical stand-point, this amount of fat is very difficult to digest and there is no reason to believe that the infant cannot make use of an extra amount of protein and sugar (chiefly the sugar) to take the place of some of the fat which is normally supplied in the breast milk. The human economy is very adaptable, so much so that the Eskimo lives almost entirely upon a protein and fat diet, and certain other races seem to thrive on high starch diets. There can be no reason why the infant cannot do this to a certain extent.

Fats possess the important property of saving nitrogenous waste, so that when these are properly supplied in the food the entire energy of the proteins may be expended upon the growth and nutrition of the cells of the body without being used up for the production of animal heat. The fats also add to the body weight by storing up fat. They are needed likewise for the growth of the nerve cells and are essential to the proper growth of bone.

Because the fat is often so difficult to digest, it is best to use whole milk properly diluted or, in some instances of extreme indigestion, skimmed milk. The average cow's milk containing 4 per cent. fat, when diluted three times (one part milk and two parts water), will give a mixture of 1.3 per cent. fat, while the same milk diluted two times (one part milk and one part water) will give a mixture containing 2 per cent. fat. In the same way, three-quarters milk and one-quarter water will give a mixture containing 3 per cent. fat. To a certain extent deficiency in fat may be made up by add-

ing sugar, and splendid results are obtained in feeding infants throughout the bottle period with a mixture containing far less fat than breast milk. For these reasons it is not necessary to use top-milk mixtures or to add cream to milk mixtures.

Emulsification of fats takes place in the small intestine, brought about by the alkaline salts of the bile, pancreatic and intestinal secretions. It is then split into soaps and glycerine and only as such can be absorbed and utilized. During absorption through the mucosa and while in the intestinal epithelium the glycerine and soaps again re-combine into neutral fats of which 60 per cent. pass directly into the systemic circulation through the lacteals and thoracic duct. The fat that is not immediately burned for food is deposited in the subcutaneous tissues and elsewhere where it may be drawn upon for future needs. In diarrhœa a large part of the fat is lost in the stool, passing out too quickly for absorption in the form of fatty acids, which further increase peristalsis. An excess of sugar in the food causes fermentation and further acidity and the combination gives a double cause for the diarrhœa. It is for this reason that sugar or fat diarrhœa rarely occur separately and whether the sugar or fat is the original cause, both must be eliminated in order to control the diarrhœa. On the other hand, a high protein and low sugar gives an alkaline intestinal content and stool, because in an alkaline medium the fat unites with the calcium and magnesium of the milk to form soaps which are insoluble, resulting in a loss of fat and a hard, dry, constipated stool. Although fat is not essential to life, since it can be replaced by carbohydrate, a long continued low fat diet in infancy lowers the resistance and possibly pre-disposes to infections.

The Sugar and other Carbohydrates.—The sugars, like the fats, cannot replace the nitrogenous waste of the body, but

they are important aids to the proteins. Their chief use in the human economy is to supply heat and energy, and they are capable of replacing fat waste in the body.

Since cow's milk diluted three times contains only $1\frac{1}{3}$ per cent. of sugar in the form of lactose, and diluted half and half contains only 2 per cent. sugar, it is necessary to add sugar to the bottle feedings in order to bring the sugar content of the food up to that of breast milk.

The carbohydrates most commonly used in infant feeding are cane sugar, milk sugar, malt sugar (maltose and dextrin), and starchy foods in the form of gruels.

Sugar is in many ways the most important element in the food, and clinical experience has brought out the fact that sugars are, in many instances, the primary cause of indigestion in infancy.

All sugars and starches must be converted into monosaccharides before absorption in the intestinal tract. These monosaccharides or end products of starch digestion are dextrose (glucose), galactose and levulose. There is no proof that milk sugar is necessary for the infant's nutrition, although it is this sugar that occurs in the milk of all mammals and there is abundant clinical experience to show that the other carbohydrates are just as beneficial and more easily digested. It is an interesting fact that intestinal bacteria that ferment one form of sugar may not ferment others, so that an infant with digestive disturbances may be benefitted by changing from one sugar to another and more than one kind of sugar in the same infant's diet may be beneficial for this reason. Starches are slowly fermented in the intestinal tract so that in certain infants they are less liable to cause diarrhœa.

A certain amount of sugar or starch is necessary to life, because they are essential to the proper combustion of fat and they may be fed in larger amounts than either protein

or fat without causing metabolic disturbances such as acidosis, provided there is no diarrhœa. All sugars and starches ingested are not absorbed since a certain amount is decomposed by intestinal bacteria into lactic, butyric and other acids and gases, and this is one of the reasons why large amounts of sugar cause diarrhœa. When an excess of carbohydrates is fed, considerable quantities remain undigested and unabsorbed and excite excessive peristalsis. The feeding of sugar is urgent in acidosis because in the absence of sugar the fats are incompletely burned, thus producing acetone bodies.

Sugar that is not burned up as food or converted into fat and thus stored up, is stored in the liver, muscles and other tissues as glycogen. As every gram of carbohydrate stored retains with it 3 grams of water, an excess of sugar in the food, if it does not cause diarrhœa, brings about a tremendous and often unhealthy gain in weight. It is a notable fact that babies fed upon condensed milk that contains over 50 per cent. of sugar are fat, but pale and flabby and are not only susceptible but are apt to succumb to infections. An exclusive carbohydrate diet, if continued long enough, will lead to a general edema due to the lack of protein and other food constituents. Infants fed over a prolonged period with barley gruel only, are therefore occasionally mistaken for nephritics.

The Mineral Salts.—The mineral salts are of even greater importance in infancy than in later life, because of the rapid growth of the bony structure which is going on at this period. The most important salts are the phosphates of lime and magnesium which are furnished in abundance in both human and cow's milk. The salts are also necessary for cell growth and are important constituents of the blood and digestive juices, facilitating secretion, absorption, and excretion.

Mineral salts fed in excess of the body requirements are excreted. A deficit of calcium salts in the blood causes

tetany and spasmophilia. A lowered calcium or phosphorus content of the blood or both is found in rickets. These diseases exist because the salts are not utilized, rather than that they are lacking in the food. Inorganic salts are furnished in breast milk in exactly the right quantities and proportions. On the other hand, while cow's milk contains three times as much mineral matter, the proportions are different and are not absorbed as well. That it is not a deficiency of calcium and phosphorus salts in cow's milk that causes rickets, is proven by the curative value of cod liver oil and sunlight which bring about the proper utilization of these salts without other changes in the food.

The Water.—The food of all young mammals contains from 80 to 90 per cent. water, which gives it the liquid form adaptable for sucking. Water is also needed in large quantities for the rapid elimination of the waste in the body.

Water evaporation from the skin regulates the heat of the body and in the presence of high external temperature, large amounts of water evaporate from the skin, preventing a rise in body temperature. When sufficient water is not furnished for elimination of waste products through the kidneys, retention of these waste products occurs. In health about 10 per cent. of the water ingested is eliminated by the bowel, but in the presence of vomiting and diarrhœa the water eliminated from the gastro-intestinal tract exceeds that taken in by mouth, causing dehydration and its serious consequences.

Vitamines.—Vitamines belong to a class of several unidentified food accessory factors, the chemical nature of which is still obscure, but whose presence in the diet of an infant as well as that of an adult is absolutely essential to maintain the proper balance of nutrition. Clinical observation and animal experiments have repeatedly proven that a diet lacking in these substances is inadequate and is followed after a period of time by definite symptoms of improper growth

and nutrition. Low mineral intake especially of calcium and phosphorus and to a lesser extent iron, will also retard growth, but here again experiments have definitely shown that this is not the essential causitive factor. It is found that life cannot be maintained in animals fed upon a diet consisting of pure carbohydrate, protein, fat and mineral salts even though present in adequate amounts and proportions. When a food containing these vitamines or accessory factors is added to such a diet, growth and development proceed in a normal manner.

There are according to present facts concerning these, four accessory food factors. They are "Fat soluble A" a deficiency of which is regularly seen associated with malnutrition and improper growth, "Water soluble B" producing beri-beri and polyneuritis when this factor is persistently absent from the diet, "Water soluble C" without which scurvy is readily produced, and the more recent "Fat soluble D" factor, the administration of which is valuable in the prevention and cure of rickets.

"Fat soluble A" is present in large amounts in the fat of cod liver oil, yolk of egg, cream, butter and glandular organs. It is present in smaller amounts in other animal fats. In vegetable fats it is absent. In the leaves of green vegetables as spinach and cabbage, it is present to a less extent. With the separation of the cream from the milk the greater part of the "A" factor passes away, but small quantities remain, however, in the skimmed milk and in the casein. Both casein and cheese therefore invariably contain "A" though in small quantities. The seeds of plants as oats, wheat, rye and barley contain too little of this factor to insure the maintenance of normal growth. A diet lacking in this substance has produced in animals a marked degree of malnutrition and a chronic inflammatory disease of the eye lids and conjunctiva known as Xerophthalmia. Both of these conditions become marked and progressive and if the

diet is not supplemented with a food containing this vitamine, there results blindness and eventually a fatal termination. Prolonged heating in the presence of oxygen will destroy it, but with oxygen largely excluded it may be kept at a temperature of 100 C. for several hours with very little change. The effect of boiling for five minutes is practically negligible.

"Water soluble B" or the antineuritic vitamine when absent from the diet over a prolonged period is considered to be the specific cause of beri-beri. Lack of this vitamine in the diet of certain birds and animals has regularly caused a polyneuritis. It is abundant and widely distributed in nature, being found in milk, vegetables, nuts, yeast and in the germ and pericarp of grains. The germs of grains are especially rich in vitamine B. In plants we find them especially in the leaves and other green parts, whereas the parts of the plants used for storage such as bulbs, tubers and roots contain them in less abundance. Still the amount in potato is so large that even boiled potatoes are useful both as a remedy and as a prophylactic. The part of the potato directly beneath the skin seems to contain the most vitamine. Beri-beri is prevalent in countries where the diet is almost exclusively of polished rice and fish. A general mixed diet is relatively rich in this vitamine and an infant receiving average amounts of human or cow's milk makes the addition of this factor to the diet unnecessary. The mortality rate in those countries where beri-beri is prevalent, among breast fed infants, is higher than in those artificially fed, which is no doubt due to the fact that the mother is not able to furnish through her own milk substances which it is impossible for her to synthesize and which she has not ingested. "B" is very stable and not destroyed by heat.

"Water soluble C" or the antiscorbutic vitamine is abundant in the juice of fruits, particularly orange and tomato juice, yellow turnips and cabbage. It is seen in

smaller amounts in the green vegetables and potato. The ordinary mixed diet will provide quantities well above the maximum requirements however, as it is widely distributed in nature. This factor is considered to be the most unstable and the most sensitive of the vitamine group. The "C" factor in milk is subject to seasonal changes, it being highest during the early summer months and lowest during the winter. It is considered by some that the essential cause of this change is due to the amount of "C" in the fodder, as during the spring and summer months the plants are in the most vigorous phase of their development and contain at this time comparatively large quantities of vitamine "C". It is for this reason that scurvy sometimes develops in bottle fed infants. The diet of artificially fed infants must therefore be guided carefully else a deficiency of this vitamine manifest itself. Experiments have shown that heating the milk at high temperatures for short periods is not as destructive for this vitamine as lower temperatures for a longer time. Clinically, scurvy does not develop as readily in milk mixtures which have been boiled for a few minutes as it does when pasteurized milk is used. Rapid cooling of the milk after boiling assists in preserving this valuable vitamine. In vegetables it may be diminished or completely destroyed by drying, and in milk by standing for several days. A few dried milks contain considerable "C" because of the short time they are exposed to high temperatures. Since the quantities of "C" in milk modification is uncertain, it is advisable to supplement the feeding in every case with orange or tomato juice.

"Fat soluble D". That cod liver oil has a beneficial effect upon rickets has long been known, but more recent work upon the subject reveals the fact that the beneficial effects derived from this oil is independent of fat soluble "A" as this vitamine can be entirely removed from cod liver oil by oxidization and still retain its effectiveness

for rachitis. This disease has also been known to develop in infants receiving milk containing considerable quantities of "A". We therefore assume from the foregoing that there is present in cod liver oil a fourth food factor "D". More recent studies upon the effect of cod liver oil in rickets have attributed this antirachitic property to a cholesterol-like substance which may be extracted from the livers of other fish as well as the cod. It is also believed that this cholesterol-like substance is found present in the skin, and that direct sunlight serves to stimulate or activate this substance to such an extent that metabolism approaches its normal state thereby preventing or relieving the symptoms of rickets, without other changes in the diet. Unhygienic conditions seem therefore to have a prominent place as an etiologic factor. The mode of action of these substances seems to be that of maintaining a normal salt relation between calcium and phosphorus so that the deposition in the bones occurs as normally. Milk contains this fourth accessory factor when the cows are exposed to sunlight or fed upon green vegetables. Fish may derive their supply by feeding upon green vegetation. In winter both these factors are lacking and it is during this season that rickets is most prevalent. The more varied and abundant diet of human beings as compared to that of domestic animals may explain the relatively small amount of rickets in breast fed as compared to artificially fed infants.

Nutritional edema is a condition resulting from a faulty diet without relation to heart or kidney disease. It has been produced in animals on diets containing all the essential food substances except an adequate protein and has been promptly relieved by the addition of casein to the food.

Therefore, in the consideration of an infant dietary it is of the utmost importance to keep these factors present in some form more specially in prematures, bottle fed babies

and those predisposed to rickets. The following protective foods being rich in all the known essential food factors should be added to the diet from time to time. They are: whole milk, orange juice, yolk of egg, cereals, cod liver oil and vegetables.

Definite nutritional diseases, arrest of growth, malnutrition and anemia seem to be dependent upon a deficiency of these factors in some form. These conditions, however mild in their manifestations, may have more remote effects upon the mental and physical well-being of the child.

CHAPTER IV

DIGESTIBILITY OF THE FOOD

It is of the utmost importance to have a food which the infant can digest, since it is utterly futile to supply the proper amount of food (fulfil the caloric requirements) and to supply the correct percentages of fat, carbohydrates and protein if the food causes gastric or intestinal indigestion. Simple milk, water and sugar mixtures have proven to be more easily digested than many of the more complicated feedings which have been used in the past.

The Proteins.—We have passed the period in infant feeding when the proteins were considered a source of *all* indigestion.

The protein of cow's milk is composed of about three-quarters casein (curds) and one-quarter albuminous protein (whey). The curds were formerly considered by many to be the element in the food most difficult of digestion. For this reason many infants who had difficulty in digesting their food were fed with whey and cream mixtures, the curds being discarded. This is called "split protein" feeding. As a matter of fact, the whey, containing as it does most of the sugar of the milk, is probably more difficult for many infants to digest than are the curds themselves when properly treated, especially when cream and artificial sugar are added. The author has discarded the use of the whey and cream mixtures because, clinically, it has been found that simple milk and water mixtures are far more easily digested.

Some authorities, in order to overcome this imagined extreme indigestibility of the curds, added alkalies. For the most part, small quantities of lime water, usually one ounce to twenty of the food, were used to overcome this difficulty. So used, lime water has little if any effect upon the

digestibility of the food. The main reason for adding alkalies would seem to be to neutralize the acid gastric juices of the stomach in order that the milk may pass on into the intestines as a fluid without curdling in the stomach. This will only be accomplished by adding large quantities of a stronger alkali than lime water, and many pediatricians have used sodium bicarbonate, sodium citrate, or potassium carbonate (2 grains to every ounce of milk) for this purpose. This probably has the effect of preventing coagulation in the stomach, but it throws most of the work which the stomach should do upon the intestines, and results in intestinal indigestion in many instances.

Another theoretical reason for the use of lime water is to supply the calcium deficiency in cow's milk. It is also said to increase the flow of hydrochloric acid in the stomach. Clinically the author has never felt that the use of lime water, in the strength ordinarily used, was of any benefit whatever, nor does he believe that it makes the slightest difference in the digestibility of the food whether lime water be given or omitted.

The protein in cow's milk, when subjected to boiling, is usually the most easily digested portion of the milk, both in the stomach and in the intestinal tract. Often, the sickest infants with the weakest digestion will digest with ease skimmed milk in strong dilutions (sometimes even undiluted) when no artificial sugar is added to the food. This, in itself, proves that the protein is not as indigestible as it was formerly thought to be.

Gruels have also been used to dilute cow's milk in order to make the protein more digestible. It is true that in the test-tube top milks diluted with gruels do not coagulate with hydrochloric acid and pepsin in as hard and tough curds as do milks diluted with plain water, but the author prefers to omit gruels in younger, smaller infants, because he believes that *occasionally* the gruels themselves are a

cause of gastric or intestinal indigestion. Infants over three months of age, who have a normal digestion, do very well upon gruels when used as a diluent for the milk, but it is chiefly for the nutritional value of the flour (which gives an additional amount of carbohydrate) that gruels are given at this time.

In certain cases of diarrhœa in infants of this age milk boiled with the gruel has a definite therapeutic value, but on the whole boiling the milk and water together is the most satisfactory way of making the proteids digestible.

Peptonizing the milk has also been popular in the past, but this method, too, usually fails to help the digestion in cases where help is most needed. The author does not believe that it is of any benefit to peptonize the food which the infant does not digest unpeptonized. Some element of the food itself is at fault, and with the proper knowledge of infant feeding one can usually permanently improve the digestion by instituting the proper feeding and with better results than by peptonizing the food.

Case I

(A case in which peptonizing the food did not overcome the infant's indigestion or vomiting)

March 10: Female, age 2 months. Birth weight, 6 lb.
Present weight, 7 lb. 2 oz.
Gain since birth, 1 lb. 2 oz.

General Condition.—Very poorly nourished, underdeveloped, good musculature, cries lustily.

Stools.—Since birth, one or two per day, small, yellow, normal consistency and odor, no mucus, curds or blood.

Vomiting.—*Since birth has vomited* (most of the feeding) immediately after feeding or within half an hour.

Appetite.—Hungry.

Sleep.—Daytime poor; at night sleeps twelve hours uninterruptedly.

Temperature, 98.6° F.

Chief Complaint.—Vomiting, improper gain in weight, crying.

Previous Food:

3 oz. top milk (22 per cent. fat)	3 oz.		
Whole milk	8 oz.		Fed 3 oz. every 2 hours, 9 feedings in 24 hours.
Water	16 oz.		
Fairchild's Peptogenic Powder	3 oz.		

Treatment.—Food prescribed:

Whole milk	10 oz.	boiled	Feed 4+ oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water	20 oz.		
Sugar	0 oz.		

The milk is to be increased one ounce each day and the water decreased the same amount until the formula is half milk and half water, or

Milk	15 oz.	boiled
Water	15 oz.	

Six days later the weight was 7 lb. (a loss of 2 oz.), the general condition was as above, the stools normal and occurring once a day. The *vomiting had stopped,* the sleep was better and the appetite still good.

The infant gained in weight when sugar was added and continued to progress normally. The previous food, though peptonized, had caused vomiting and much discomfort. The food that was instituted was much better digested than the peptonized food, although it contained almost as much milk as the former. The fat of the top milk and the large amount of milk sugar given in the form of peptogenic milk powder caused indigestion which could not possibly be overcome by peptonizing the mixture.

It is now generally conceded that boiling the milk is the best and easiest and most effective method of making the curds digestible, and it is therefore unnecessary to add alkalies or peptonizing agents or gruels for this purpose.

Boiling the milk has been found of the most help in cases where the proteid does not seem to be well digested. Brannaman has shown that tough, hard curds stay in the stomach for many hours when raw milk is used and that the curds are flocculent and easily digested when the milk is boiled. The author has never seen a case in which hard, bean-like curds occurred in the stools, where the curds could not be stopped by boiling the milk. This experience has been re-

peated so many times that there cannot be the slightest doubt of the beneficial influence of boiling the milk where the necessity for such boiling is indicated by the condition of the stools. (See Chapter XXI.)

CASE II

(A case in which intestinal indigestion—diarrhœa—was overcome by boiling the milk)

May 6: Male, age 3 months. Birth weight, 6 lb. 8 oz.
Present weight, 8 lb. 4 oz.
Gain since birth, 1 lb. 12 oz.

General Condition.—Fairly well nourished.
Stools.—For four days *has had each day 6 or 7 loose, watery stools*, yellow or green, of normal odor, with considerable mucus and *many tough, hard curds*, but no blood.
Vomiting.—None.
Appetite.—Poor. (Leaves some of the food.)
Sleep.—Restless and intermittent.
Temperature.—98.6° F.
Chief Complaint.—Diarrhœa.

Previous Food:

Milk	18 oz.	unboiled	Fed every 3 hours, 7 feedings in 24 hours.
Water	18 oz.		
Cane sugar ...	1 oz.		

Treatment.—Food prescribed:

Milk	18 oz.	boiled	Divide into 7 feedings of 5 oz. each, to be given at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water	18 oz.		
Sugar	1 oz.		

May 9: 3 days later. Weight, 8 lb. 4 oz.
No gain or loss.

General Condition.—Unchanged.
Stools.—*Two large, firm*, homogeneous, yellow stools of normal odor, *containing no curds*, mucus or blood.

The curds did not reappear in the stools later when the milk and sugar was gradually increased in quantity. It is usually advisable to stop all sugar temporarily in such cases, but this case is cited to show that without changing the food in any other way, except by boiling the milk, diarrhœa can be occasionally overcome. (See diarrhœa.)

Lactic Acid Milk is now much in use and many authorities are recommending it, instead of boiled milk. There is no question that the proteins of milk are more easily di-

gested when treated in this way than they are when raw milk is given, but there is doubt in the author's mind as to its universal application instead of boiled milk. The acidity of the stomach contents of normal infants fed on breast milk is much greater than that of infants fed on raw cow's milk, because cow's milk has the capacity to bind chemically larger amounts of acid. The stomach must secrete three times as much acid to bring the free acidity of the stomach contents to the same point when raw cow's milk is ingested as is necessary with breast-milk. When cow's milk is soured its "buffer" substance is neutralized, that is, the substance in cow's milk which must combine with acid before digestion is already acidified.

Raw milk sours with age because the lactic acid producing bacteria multiply and outgrow the other organisms in the milk. Milk may be artificially soured by inoculating it with the acidophilous or Bulga bacillus. When the lactic acid reaches five tenths or seven tenths per cent. in strength in the soured milk the growth of all bacteria, especially the lactic acid producing organisms, is inhibited and the acidity does not increase much further. This acidity neutralizes the buffer substance of the milk so that less acid has to be secreted in the stomach in order to digest the milk, and it has been shown that infants are able to take larger quantities of soured milk than of raw sweet milk without developing gastro-intestinal disturbances.

Lactic acid milk may be prepared in two ways, either by adding the cultures to the milk or by adding U. S. P. lactic acid. In using the cultures, add a stock culture to half a cup of milk and let it stand in a warm place until sour, usually about twelve hours. This may then be used to sour the amount of milk needed by mixing it with sweet milk and allowing it to stand, repeating the process day after day by using half a cup of this soured milk to inoculate the next day's feedings. Continued practice as to the

exact temperature and length of time for souring makes the mother expert. The larger dairies in the city usually supply an artificially soured milk.

The easiest way to prepare lactic acid milk is to boil or pasteurize one quart of fresh milk and after chilling it (for it must be cold), stir in two teaspoonfuls, one drop at a time, of U. S. P. lactic acid.

It is said that more sugar can be fed when lactic acid mixtures are used than with sweet raw milk, but it has long been known that this is equally true of boiled milk mixtures. Boiled milk is preferable as a routine, but in certain cases where the acidity of the stomach is low as in coealic disease and marasmus and certain prolonged gastric and intestinal disturbances, lactic acid milk is extremely useful.

In lactic acid milk the casein is partly precipitated in a fine flocculent curds and it is because of this that the thick appearance is given it. It also has a sour taste which is not agreeable to many infants, although a very hungry baby will eventually take it or any other strange tasting food after several trials and considerable persistence.

The protein of dried milk and evaporated or condensed milk is also changed during the process of drying or evaporation, much in the same way as by boiling. With dried milk the buffer substance is changed by the drying process, the calcium salts of the milk being changed to an insoluble form.

The Dietary Value of Gelatine has long been recognized although until now, the basic reasons have been somewhat clouded by varying theories. Among the recognized protective colloids, none has a higher degree of colloidal potency than edible gelatine. It has now been conclusively established that the value of edible gelatine in infant feeding is due to its colloidal action in emulsifying the milk

curds, and to the presence (to the extent of 5.9) of lysine, an amino acid which promotes growth. Similarly protective colloids in the form of albumins and gelatine are of the highest importance in maintaining an emulsion of the fats which are ingested, and in that way preventing digestive disorders that would result from the non-emulsification of the fat masses. Edible gelatine is the most important member of the group of colloids, the dietary importance of which is becoming more and more appreciated by all pediatricians and food authorities. Aside from this it is of itself the most easily digested of all proteins. Working on this basis it has been demonstrated that one of the most valuable uses to which gelatine can be put is in combination with the milk formulas in the feeding of infants. It is of value to the infant in at least two ways. In the first place, because of its powerful colloidal action, gelatine causes the casein to curd in small soft, and easily digestible curds and thus prevents the formation of the hard, tough curds which so often cause digestive disturbances and are of more or less common occurrence in infants' stools. Although gelatine may not in exceptional cases absolutely prevent the formation of curds, these indigestible masses will surely be reduced in size and softened in substance for easy digestion by the addition of a small amount of dissolved gelatine to the milk formula. Gelatine is of particular value in the diet of the growing child, because of its relatively high content of lysine, one of the amino acids necessary for growth.

For infants three weeks to six months old add one-half teaspoonful of gelatine to the day's milk formula. For babies six months old and up add one teaspoonful of gelatine to the day's milk formula. First soak the gelatine for ten minutes in one ounce of cold milk taken from the

day's formula. Then add one ounce of hot milk from the day's formula. Stir until dissolved and add this solution to the full quantity of the day's formula, stirring until thoroughly mixed.

In a way, it is a mistake to speak of protein indigestion or fat indigestion or sugar indigestion as separate entities, for in this way a false impression is gained. Undoubtedly an excess of any one of these constituents of the food will cause digestive disturbances, but once the digestion is upset by the fat or sugar or protein, the power to digest any of the elements of the food is diminished. An infant whose digestion has been badly upset by too much fat cannot digest the usual and normal amount of either sugar or protein. It is just as ridiculous to speak of such a case as "fat indigestion" as it would be to speak of "green apple indigestion" in an older child who has eaten green apples and has, therefore, temporarily lost its power of digesting any kind of food. In other words, a baby who has been fed a high fat mixture until it has caused indigestion, might have casein curds in the stools because the digestive apparatus is not in a condition to take care of the protein. The same is true of "sugar indigestion." Usually it is not sufficient to simply cut down the fats in treating an infant with indigestion caused by fat, nor is it effective simply to cut down the sugar when that is the source of the disturbance. The indigestion itself must be treated as such. For this reason, in addition to cutting down the fats and sugar, all infants with indigestion should be given boiled milk in order to increase the digestibility of the protein. (See page 309.)

The Fats.—It is now generally conceded that high fat mixtures are not to be used with infants having digestive disturbances, and the majority of pediatricians at the present time believe that, even for well infants, the fat as it

occurs in the average (4 per cent.) cow's milk is sufficient to maintain the proper nutrition when diluted correctly for the individual infant. In this country, where percentage feeding has been popular and carried to extremes, the fat has probably been the cause of more indigestion than any other element of the food. At the present time, with a few notable exceptions, those who are still percentage enthusiasts do not use milk that contain more than 8 per cent. fat (this diluted with equal parts of water gives a mixture containing 4 per cent. fat; diluted three times gives 2⅔ per cent. fat, etc.), and simple mixtures of whole milk are becoming more and more popular. For this reason, indigestion caused by high fats is not seen as often as when 12 per cent. or even 20 per cent. milk was used to make the dilutions. There is very little danger of the fats causing indigestion in well infants when proper dilutions of whole milk (4 per cent. fat) are used. Most infants who already have indigestion from fat may be started with one-third milk and two-thirds water, provided the sugar is left out temporarily, although it is occasionally necessary to use skimmed milk in severe cases of indigestion caused by fat.

Case III

(A case of intestinal indigestion—diarrhœa—caused by too much fat, overcome by cutting down the fat, omitting the sugar, and boiling the milk)

August 6: Female, age 6 weeks. Birth weight, 7 lb. 8 oz.
Present weight, 8 lb.
Gain since birth, 8 oz.

General Condition.—Poorly nourished, feeble cry.

Stools.—For four days, *each day 6 or 7 small, green or yellow watery stools of* normal odor, *with much mucus and many soft and tough curds,* no blood. Formerly constipated.

Vomiting.—None.

Appetite.—Good.

Sleep.—Poor, night and day.

Temperature, 98.6° F.

Chief Complaint.—Diarrhœa, fretfulness and sleeplessness.

Previous Food:

Milk, top 2 oz. from each of 3 qt. bottles (24 per cent. fat)	6 oz.	Fed 3 oz. every 2½ hours, 8 feedings in 24 hours.
Water	14 oz.	
Sugar of milk	6 teaspoonfuls	

Treatment.—Food prescribed.

Whole milk	10 oz.	boiled	Divide into 7 feedings of 4+ oz. each. Feed every 3 hrs. at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water	20 oz.	boiled	
Sugar	0		

August 10: 4 days later.

General Condition.—The same.

Stools.—*One large, yellow, firm, homogeneous stool*, of normal odor, *with no mucus, curds* or blood.

Vomiting.—None.

Appetite.—Ravenous.

Sleep.—Poor (on account of hunger).

The high percentage of fat that was used in the first formula caused diarrhœa and at the same time did not furnish enough nourishment for the infant. In some instances, vomiting also is caused by these high fat mixtures. Subsequently the food was gradually increased in strength and sugar was added with no return of the diarrhœa or intestinal indigestion.

The Sugar.—Sugar is, in many ways, the most important element in the food. At least, it gives the most trouble when wrongly used, and, by manipulating the artificial sugar properly, digestive disturbances can often be overcome without changing the food in any other way. Sugar serves two purposes in an infant's food. First, it supplies a large amount of nourishment because of its high caloric value, and, second, it helps to make up any deficiency in the fat which may possibly exist in the food. Besides this, it is often a laxative. Fresh cow's milk is not a properly balanced diet and an infant cannot be made to gain and thrive upon milk and water mixtures without the addition of sugar or some other carbohydrate.

It is still a question what kind of sugar may preferably be used in infant feeding. Many theoretical papers have been written upon the subject, all of which seem logical, each one proving its case for a different kind of sugar. It is hard, too, to prove clinically that one form of sugar is better than another because of other considerations entering into the discussion besides the sugar, different authorities using various kinds of formulas. Some authorities claim that malt sugar is more laxative than cane sugar (ordinary granulated sugar), while others state that the reverse is true.

The author can give only his own opinion, based upon actual clinical experience rather than upon theoretical grounds. He has found that the ordinary infant, having a normal digestive capacity and never having had much digestive disturbance, will do very well upon cane sugar. Malt sugar (maltose and dextrin), however, seems to be more easily digested and better taken care of by infants having had much digestive trouble. There are many malt sugars on the market, most of which are composed of about one-half

dextrin and one-half maltose. One that is largely used in this country is dextri-maltose,[1] which is similar to the German "Nahrsucker," a preparation that is very expensive on account of its being imported. Karo or corn syrup which is on the shelves of almost every grocer in this country is a malt sugar composed of 55 per cent. dextrin, 30 per cent. maltose and 15 per cent. glucose. It has the advantage of being cheap and available and many authorities prefer it to other malt sugar preparations, but it has the disadvantage of being in liquid form. Milk sugar has been the sugar of choice for so many years that it would seem almost heresy to speak against it. However, malt sugar and cane sugar are now fast taking its place, and the author believes that the two latter are of greater value. He now uses milk sugar very little, believing that it is often a source of indigestion in normal infants, and that it is not as well borne by those having digestive disturbances.

Finkelstein and Meyer believe that milk sugar is the primary cause of fermentative dyspepsias of infancy, and that when there is a disturbance of the utilization of fat in these conditions it is a secondary manifestation.

Occasionally it is necessary to change from one kind of a sugar to another because an intolerance for one sugar has been acquired. For instance, an infant who has been getting malt sugar has an attack of diarrhœa (intestinal indigestion) or perhaps there have been several attacks. All sugar is omitted from the food and the stools become normal again. A small amount of malt sugar is then added to the food and soon the stools become loose again. This indicates that this infant has a more or less permanent intolerance for malt sugar, or that the malt sugar has been increased too rapidly. This infant should never be given malt sugar again but instead cane sugar should be used. Some infants

[1] Dextri-Maltose is made by the Mead Johnson Co., Jersey City, N. J.

acquire an intolerance for all kinds of sugar so that whenever a small amount of sugar of any kind is added to the milk and water mixture, the stools get loose and an attack of intestinal indigestion results. Since it is impossible to make a small infant increase its weight and prosper when it is fed milk and water alone, it is then necessary to use a food which will accomplish this end without the addition of artificial sugar. Dry milk answers this purpose remarkably well because a rapid increase in weight can be brought about by the use of dry milk and water alone without the addition of artificial sugar. (See chapter on Dry Milk, page 325.)

There is a certain class of cases that do not do well on either dextri-maltose, cane sugar or milk sugar, and who thrive astonishingly well upon malt soup extract made after Keller's formula (see page 338, malt soup). Malt soup extract is a viscous liquid of amber color about the consistency of very thick syrup. It contains 62 per cent. maltose, and seven grains of potassium carbonate are added to every ounce of the malt extract. It is used with the proper milk and water mixtures, adding equal parts (by bulk) of wheat flour. Generally, however, most babies thrive satisfactorily on the less expensive and more easily prepared forms of sugar.

Case IV

(Illustrating the use of malt soup extract when other kinds of sugar have caused digestive disturbances)

December 14: Female, age 5 months. Birth weight, 8 lb. 14 oz.
Present weight, 13 lb. 13 oz.
Gain since birth, 4 lb. 15 oz.

General Condition.—Pale, moderately well nourished, extremely rhachitic, with markedly asymmetrical head. Eczema for last five or six weeks.

Stools.—One or two hard constipated stools a day, green in color, occasionally with some mucus.

Vomiting.—Very little.

Appetite.—Exceedingly hungry.

Sleep.—Poor; cries with colic night and day.

Temperature, 98.6° F.

Chief Complaints.—Colic, hunger, eczema, hard constipated stools, rickets.

Previous Food.—Breast-fed for the first two months, developing rickets during that time. Since then has been carefully fed with the proper milk mixtures. Both cane sugar and dextri-maltose had been used. *Throughout this period there was indigestion most of the time even when the stools were normal. The baby has not gained in weight for the last month.* For the last week has been fed

Milk	21 oz.	boiled	Divided into 6 feedings, fed 6 oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M.
Water	21 oz.		
Dextri-maltose..	½ oz.		

Treatment.—Food prescribed:

Milk	21 oz.	Divide into 6 bottles; feed 6 oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M.
Water	21 oz.	
Malt soup	1 tablespoonful	
Wheat flour	1 tablespoonful	

December 21: 7 days later. Weight, 14 lb. 5 oz.
Gain, 8 oz.

General Condition.—As at last date, except that infant looked much happier, as shown by the facial expression. Eczema is somewhat better.

Stools.—One soft, smooth, brown, normal stool a day.

Vomiting.—None.

Appetite.—Very hungry.

Sleep.—Much improved; never cries except immediately before feeding when hungry.

Treatment.—Food prescribed:

Milk	24 oz.	Divide into 6 bottles; feed 6+ oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M.
Water	24 oz.	
Malt soup	2 tablespoonfuls	
Wheat flour	2 tablespoonfuls	

December 28: 7 days later. Weight, 15 lb.
Gain, 11 oz.

General Condition.—Improved; eczema almost entirely disappeared.

Stools.—One normal stool a day.

Vomiting.—None.

Appetite.—Good.

Sleep.—Good.

This infant continued to do well and to gain about eight ounces a week on the above mixture. The immediate improvement when malt soup was started was remarkable, as is often the case. Although there had previously been no gain in weight during the last month under the most careful supervision and regulation of the food, the very first week on this formula produced a gain of eight ounces, the baby stopped crying, and all signs of colic and indigestion disappeared.

It is well to bear constantly in mind the laxative action of sugar, for infants who have a tendency to diarrhœa can take less sugar in the food than can those who have a tendency to constipation. Older infants who have a tendency to diarrhœa and who get up intestinal indigestion if sugar is added to the food may have the sugar deficiency made up in gruels, cereals and breadstuffs. These infants may digest their food perfectly as long as there is no artificial sugar in the food, but as soon as the sugar is added an attack of diarrhœa follows.

Case V

(A case of sugar idiosyncrasy in which any sugar whatever gave rise to diarrhœa)

July 19: Female, age 9 months. Birth weight, 5 lb. 3 oz.
Present weight, 15 lb. 8 oz.
Gain since birth, 10 lb. 5 oz.

General Condition.—Excellent.

Stools.—Many attacks of diarrhœa since birth. Ten days ago began again having *5 or 6 stools per day, brown, watery, foamy, sour smelling, with some mucus* but no curds or blood.

Vomiting.—None.

Appetite.—Poor; leaves 2 or 3 oz. at a feeding.

Temperature, 98.6° F.

Sleep.—Good.

Chief Complaint.—Recurrent diarrhœa.

Previous Food:

Milk .... 32 oz.
Water .... 16 oz.
Sugar .... ½ to 1½ oz.

Fed 8 oz. every 3 hours, 6 feedings in 24 hours. (The various kinds of sugar had been used at different times.)

Treatment.—Food prescribed:

Water .... 24 oz. } boiled
Milk .... 24 oz. } boiled
Sugar 0

Divide into 6 bottles of 8 oz. each. Feed every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M.

In four days the stools had become normal (2 per day) and remained so as long as no sugar was added to the food. However, *it was subsequently attempted to add the various kinds of sugar*, including cane sugar, dextri-maltose and malt soup, *resulting in diarrhœa* each time because of this infant's peculiar susceptibility to any form of sugar. Since she was nine months of age it was found best to make up the deficiency in carbohydrates with gruels, cereals, etc., and the baby eventually progressed nicely with a food free of artificial sugar. It is not possible to make up this carbohydrate deficiency entirely with starch, in younger infants for whom the dry milk is preferable.

The Quantity of Sugar.—A fixed quantity of sugar, either one ounce or one and a half ounces (by weight), may be used in feeding all *well* babies, provided they have the power to digest this amount, because it has been found from a practical standpoint that such an amount supplies the carbohydrate needs, supplementing the sugar that the cow's milk itself contains. Even though the quantity of artificial sugar remains constant, the total amount of sugar in the food increases with the increase in the quantity of milk. Whether one or one and a half ounces is used depends upon the infant's weight. *A well infant under ten pounds in weight should receive one ounce of sugar in twenty-four hours and an infant over ten pounds may have one and a half ounces of sugar in twenty-four hours.* It is well, however, not to give this amount of sugar at first. (Two level tablespoonfuls of cane sugar—levelled with a knife—or three of milk sugar or four of dextri-maltose, equal one ounce by weight.)

The rapidity with which the sugar is increased to one or one and a half ounces depends upon (1) *whether the infant has formerly had sugar or not*, or (2) *whether there has been previously any diarrhœa or vomiting*, and (3) *upon the severity and duration of the attacks.*

(1) The infant who has been fed a sugar-free food, or one without any artificial sugar in it, must have his tolerance for sugar gradually increased by increasing the sugar slowly. If one ounce of sugar in the twenty-four-hour amount is given at first, diarrhœa or vomiting may be the result. For this reason, the sugar must be added one teaspoonful at a time and at intervals of two or three days, until the required amount is reached. This does not seem to be generally understood, particularly by those who use stated formulas. If a sugar intolerance is once brought on by too much sugar, an infant may never have as great a tolerance for sugar again. It is a great temptation to increase the sugar rapidly when an infant is hungry and crying and really needs more food, but yielding to this temptation is

almost sure to end in trouble. When the quantity gets as high as four teaspoonfuls the sugar is then measured with a tablespoon levelled with a knife, because tablespoons run much more uniform in size.

CASE VI

(A case in which the sudden addition of a large amount of sugar caused intestinal indigestion (diarrhœa), showing the importance of increasing the sugar gradually)

December 3. Male, age 7 months — Birth weight, 5 lb.
Present weight, 12 lb. 4 oz.
Gain since birth, 7 lb. 4 oz.

General Condition.—Pale, fairly well nourished, musculature fair, rhachitic rosary, flaring of ribs, Harrison's groove, no teeth.

Stools.—Habitually constipated; one hard stool a day with the aid of milk of magnesia.

Vomiting.—Occasional.

Appetite.—Good.

Temperature, 98.6° F.

Sleep.—Good, night and day.

Chief Complaint.—Constipation.

Previous Food:

Milk (unboiled)	1 cup	Fed 8 oz. every 3 hours, 7 feedings in 24 hours.
Water	1 cup	
Sugar	0	(This formula was made up several times a day)

The mother had been advised by a neighbor to put sugar in the food on account of constipation, which was a good suggestion had it been properly done. Instead of adding it gradually, she *gave one and a half ounces of cane sugar the first day, with the result that within a short time the stools became loose,* and the slight vomiting already present was increased. This baby did not have permanent intolerance of sugar because, after the diarrhœa was stopped, sugar was gradually added (¼ oz. every two or three days up to 1½ oz. in 24 hours) without any ill effects.

(2) If cane sugar or milk sugar has been used in an infant's food and it is considered desirable to change to malt sugar, one must be almost as cautious in increasing the sugar as though the infant had never had any sugar at all. The same is true of changing from milk sugar or malt sugar to cane sugar. When a new kind of sugar is used the tolerance for that sugar must be increased by gradually increasing the amount of sugar just as carefully as though the infant had previously never taken any sugar at all.

Case VII

(A case of indigestion caused by a top milk and an excessive amount of milk sugar, showing the necessity of gradually increasing the quantity of sugar when the kind of sugar is changed)

October 31: Male, age 9 months. Birth weight, 7 lb.
Present weight, 14 lb. 10 oz.
Gain since birth, 7 lb. 10 oz.

General Condition.—Fairly well nourished, underdeveloped, pale.
Stools.—Two normal a day.
Vomiting.—None.
Appetite.—Good.
Temperature, 98.6° F.
Sleep.—Good.
Chief Complaint.—Not gaining properly in weight; *has occasional attacks of colic, poor appetite, coated tongue and foul breath.*

Previous Food:

Milk, top 16 oz. (7 per cent. fat)	16 oz.	Fed 5 oz. every 3 hours,
Barley gruel	16 oz.	6 feedings in 24 hours.
Milk sugar	2 oz.	

Treatment.—Food prescribed:

Whole milk	20 oz.	boiled	Divide into 6 feedings of 8 oz. each. Feed every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M.
Water	28 oz.		
Cane sugar	1/4 oz.		

Each day increase the milk one ounce and decrease the water one ounce up to

Milk	24 oz.	boiled
Water	24 oz.	
Cane sugar	1/4 oz.	

Every third day increase the sugar 1/4 oz. up to 1 1/2 oz. in 24 hours.

With this gradual increase there was no recurrence of the digestive disturbances and a progressive gain in weight took place as soon as the caloric requirements were fulfilled.

(3) Infants who have had many attacks or one prolonged attack of vomiting or diarrhœa may not be able to take any sugar at all for a time. In such cases calcium caseinate described in the treatment of diarrhœa is of great value. If an infant has recently recovered from a diarrhœa of not more than one or two weeks' standing, or if it has never had more than one or two attacks of diarrhœa, the sugar, either malt sugar or cane sugar, will be well borne if it is increased very gradually. It should be added one teaspoonful at a time in such instances. One rarely regrets increasing the sugar too slowly in infants that have had diarrhœa.

CHAPTER V

THE PROPER QUANTITY OF FOOD TO SUPPLY THE CALORIC NEEDS

It is a well-known principle of physiology that every individual needs a certain definite quantity of food to maintain nutrition and to supply heat for the body, to make up for the loss of heat from the body surface, and to furnish energy used in muscular and organic activity. The amount of food needed varies with the size of the individual, with the condition of his nutrition, with the amount of energy which he expends, and with the heat he loses. The infant normally doubles his weight in the first six months of life and therefore needs an extra supply of food for this purpose. The definite quantity of food every individual must receive is best expressed in terms of calories.

There is nothing mysterious about calories. A ton of coal put into a furnace has a given value, measured by the amount of heat and possibly the energy it supplies to an engine. The term or unit which is used to express the value of this coal is a calorie.[1] A ton of coal, therefore, has a certain definite caloric value. In the same way, an ounce of milk when utilized by the human economy has a certain definite value, and will produce a certain amount of heat, energy and growth. An ounce of sugar or flour or any other food also has a certain definite caloric value. The values of these different foods have been determined by physiologists and chemists and the caloric values of all foods are now definitely fixed and known. It is a more or less complicated matter to reckon the number of calories that an adult takes in twenty-four hours, because the food

[1] A calorie is the amount of heat necessary to raise the temperature of 1 kilogramme of water 1° C.

is so varied and the amounts are often difficult to measure, but it is a very simple process to reckon calories for infants when their food is limited to milk, sugar, and possibly one of the cereal flours. We practically have only four figures to remember in the

CALORIC VALUE OF INFANTS' FOODS

1 oz. of milk[3]	= 20 calories.
1 oz. of sugar (by weight)	= 120 calories (any kind of sugar).
1 oz. of flour (by weight)	= 100 calories.
1 oz. malt soup extract (by weight)	= 90 calories.

2 scant tablespoonfuls of malt soup extract	= 1 oz. by weight.
2 level tablespoonfuls of cane sugar	= 1 oz. by weight.
3 level tablespoonfuls of milk sugar	= 1 oz. by weight.
4 level tablespoonfuls of dextri-maltose	= 1 oz. by weight.
4 level tablespoonfuls of flour	= 1 oz. by weight.

(Tablespoons to be levelled with a knife)

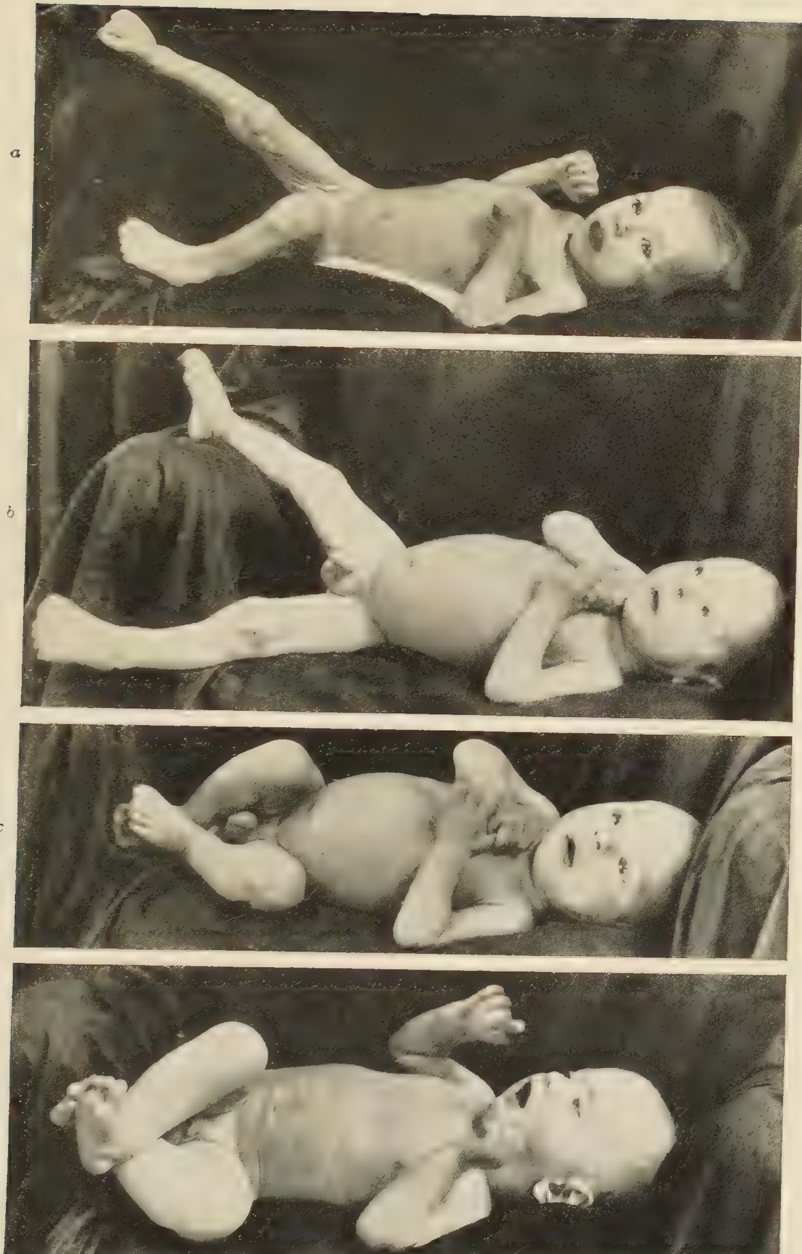
The only other figures that we have to remember are the number of calories per pound weight the individual infant needs, since all infants do not require the same number of calories.

CALORIC REQUIREMENTS OF BOTTLE-FED INFANTS

Fat infants over four months of age	need 40 to 45 cals. per lb.
Average infants under four months of age and moderately thin infants of any age.	need 50 to 55 cals. per lb.
Emaciated infants (varying with the degree of emaciation)	need 60 to 65 cals. per lb.

The very fat infant has less body surface in proportion to its weight and therefore loses less heat from the surface

[3] See table of caloric values of milk, page 409.



a

b

c

d

FIG. 5.—(a) Emaciated infant; (b) poorly nourished infant; (c) moderately well-nourished infant; (d) well-nourished infant.

of the body than the emaciated infant. A fat man feels warmer in the hot weather than a thin man, since the fat man has not as much body surface in proportion to his weight as the thin man. It can readily be seen that a man weighing 200 pounds cannot have anywhere near twice as much body surface as a man weighing 100 pounds, and, therefore, since a large amount of food that we take is lost in heat, the fat man does not need as much food *in proportion to his weight* to maintain his nutrition and to utilize in heat and energy. For the same reason the fat infant does not need as many calories as the thin one. The number of calories which infants need has been determined by metabolism and calorimetric experiments; also by taking a large series of infants of various ages, weights, and nutritional conditions, and ascertaining by clinical observation the number of calories they require to develop properly and gain in weight.

When we see an infant for the first time, it is a matter of judgment whether it is a 40-calorie infant or a 60-calorie infant, but with the above standards to help us out it is fairly easy to determine this matter, especially after a little experience. For instance, if we see an extremely emaciated infant, we can tell at a glance that it must take and digest 65 calories per pound in order to maintain nutrition and make the proper gain in weight. On the other hand, if it is very fat and over four or five months of age, we know that it will probably do well on 40 or 45 calories per pound, and if in our opinion it seems to be the average infant, 50 or 55 calories per pound will be sufficient food for it.

As an example, take an infant that weighs twelve pounds at four months of age. It would be about the average infant and if, after examining it, it was seen that it was moderately well nourished, we would know that it needed 50 calories per pound body weight in twenty-four hours. This would make 600 calories of food which this infant needs to maintain nutrition and gain in weight ($12 \times 50 = 600$). Since well

infants over ten pounds in weight require 1½ ounces of sugar in the twenty-four-hour amount of food (see page 66) and we are giving plain milk, water and sugar mixtures, we find, by subtracting the caloric value of this 1½ ounces of sugar (180 calories) from the total number of calories necessary, that 420 calories of milk must be given (600 − 180 = 420). This 420 calories of milk (since there are 20 calories to every ounce of milk) would give us 21 ounces of milk (420 ÷ 20 = 21). Such an infant then needs in twenty-four hours 21 ounces of milk, 1½ ounces of sugar. Assuming for the moment that this infant could take 42 ounces of food in twenty-four hours (see page 74), sufficient water must be added to make up the 42 ounces. It would then be made up in the following manner:

Milk, 21 oz.	420 cals.
Water, 21 oz.	
Sugar, 1½ oz.	180 cals.
	600 total calories in 24 hours.

As a second example, imagine an emaciated infant, five months old, weighing seven pounds, who has no digestive disturbances. According to our table of caloric requirements, this infant would need 60 to 65 calories per pound. Since this infant is in an extreme condition of emaciation, the maximum limit of food value, which is 65 calories per pound in twenty-four hours, should be given; 65 (cals.) × 7 (lbs.) = 455 cals., total number of calories needed in twenty-four hours. Of this total 455 calories, 120 calories may be given in the form of sugar, *since an ounce of sugar may be given in twenty-four hours;* 455 − 120 = 335 calories of milk needed in twenty-four hours. Since there are 20 calories to each ounce of milk, we must use 16½ ounces of actual milk in the food given (335 ÷ 20 = 16 +). Assuming for the moment that this infant can take 35 ounces of food in twenty-four hours, sufficient water must then be added

to make up the 35 ounces. We will, therefore, disregarding the fraction of an ounce, give in round numbers:

Milk, 17 oz.	340 cals.
Water, 18 oz.	
Sugar, 1 oz.	120 cals.
	460 total calories in 24 hours.

It is best to disregard the fractions of an ounce, because it is not necessary to make the mother go to the trouble of measuring less than an ounce, and so small a deviation from the caloric requirements makes no difference to the infant. It is also usual to disregard the extra bulk (which is a mere fraction of an ounce) which the dissolved sugar adds to the formula.

Again it must be explained that *if the infant has diarrhœa, vomiting, or loss of appetite, this food which supplies its actual needs will only serve to increase these symptoms and should, therefore, not be given until such symptoms have first been successfully treated.* Again it must be emphasized that *if the infant has not been receiving sugar in its food, or has been getting no milk or much smaller amounts of milk, these ingredients must be increased gradually,* not expecting any gain in weight until the caloric needs are supplied.

How to Determine the Quantity of Water.—The quantity of water which is added to the milk and sugar depends upon the amount of food that the infant can take in twenty-four hours; that is, the amount of milk and sugar being determined, the rest of the food must necessarily be water. There is always this proviso: *an infant under ten pounds weight or one that has recently recovered from digestive disturbances should not be fed with a stronger dilution than half milk and half water.* The twenty-four-hour quantity of food in turn depends upon the number of ounces that an infant may take at one feeding and the number of feedings

in twenty-four hours. If an infant can take six ounces at a feeding, seven feedings a day, the twenty-four-hour quantity will be 42 ounces ($6 \times 7 = 42$).

We must, therefore, have a rule for the quantity that may be given in a single feeding and a rule for the number of feedings in twenty-four hours which will apply to all infants.

How to Determine the Quantity Given in a Single Feeding.— A good rule for the quantity to be given at a single feeding is as follows: *A large infant or an infant of average size for its age should have at each feeding one or two ounces more than the number of months of its age. The undersized infant should have at each feeding an ounce for each month of its age.* Sometimes an extremely small, undersized, feeble infant, perhaps with vomiting, cannot take even one ounce for each month of age, but these are extreme cases. This rule has two limitations, the first concerning the minimum quantity and the second concerning the maximum quantity that any infant should take. (1) It is never necessary to give any infant more than eight ounces at a feeding, or forty-eight ounces in twenty-four hours, and (2) during the first weeks of life the quantity at each feeding should be increased as rapidly as possible up to three or four ounces at each feeding, the guide being the amount that the infant will take.

It will be seen from the above rules that the quantity given at a feeding depends chiefly upon the infant's age, although some allowance is made for its size. For instance, the average sized infant of four months of age should be given six ounces at a feeding. The undersized infant of that age should not be given any more than four ounces at a feeding, while the extremely small, feeble infant of four months, weighing only five or six pounds, may not be able to take more than three ounces.

The quantity that an infant may take at a feeding does not depend, as formerly thought, upon the actual holding capacity of the stomach. Since it takes twenty minutes for

the average infant to take the bottle, a large part of the food has passed out of the stomach through the pylorus before the feeding is finished, so that the stomach never has to hold at any one time all the food given at a single feeding. This has been determined by X-ray experiments and is an established fact. We can now see the folly of measuring post mortem the capacity of the stomachs of infants of different ages, as was formerly done, to determine the amount of food that might be taken at a single feeding.

Number of Feedings in Twenty-four Hours and the Intervals between Feedings.—There is a great difference of opinion concerning the length of time that should elapse between feedings. Formerly pediatricians recommended two-hour intervals for all infants under four months of age, gradually increasing the intervals after this age up to three hours between feedings. Others use four-hour intervals for all infants of any age, sick or well, and are particularly insistent upon the four-hour intervals for sick, weakly infants. The author, after a thorough trial, has come to the conclusion that the happy medium is the wisest course. The three-hour intervals from 6 A.M. to 10 P.M., with one feeding at 2 A.M. (seven feedings in twenty-four hours), agree with most infants up to three or four months of age. After that age, or better still, when the infant weighs twelve pounds, the 2 A.M. feeding should be omitted, giving six feedings in twenty-four hours. These six feedings may be continued up to five months of age or fifteen pounds in weight, when the four-hour intervals are best, making five feedings in the twenty-four hours.

In order that a larger twenty-four-hour amount and, therefore, a more dilute food, may be given, it is occasionally necessary to feed once in two hours from 6 A.M. to 10 P.M., with one feeding at 2 A.M., giving ten feedings in twenty-four hours. It is only in the most extreme cases of undersized, feeble or premature infants weighing less than five pounds that it is necessary to resort to these two-hour intervals.

It is well to have the following facts on the tip of the tongue: *two-hour intervals with one night feeding,* best coming at 6, 8, 10, 12 A.M., 2, 4, 6, 8, 10 P.M. and 2 A.M., *make ten feedings in twenty-four hours. Three-hour intervals with one night feeding,* best coming at 6, 9, 12 A.M., 3, 6, 10 P.M. and 2 A.M., *make seven feedings in twenty-four hours. Three-hour intervals without any night feeding,* best coming at 6, 9, 12 A.M., and 3, 6, 10 P.M., *make six feedings in twenty-four hours. Four-hour intervals,* best coming at 6, 10 A.M., 2, 6, 10 P.M., *make five feedings in twenty-four hours.*

One may then know at a glance that if an infant is fed every two hours with one night feeding and is getting three ounces at a feeding, this will give thirty ounces in twenty-four hours ($10 \times 3 = 30$). Or, for instance, an infant that is being fed every three hours with one night feeding is getting seven feedings in twenty-four hours, and if it is capable of taking six ounces at a feeding, it would therefore be getting forty-two ounces in twenty-four hours ($7 \times 6 = 42$).

CASE VIII

(Illustrating the method of feeding an infant, using caloric requirements as a standard)

June 9: Female, age 2½ months.

Birth weight, 6 lb. 9 oz.
Present weight, 6 lb. 15 oz.
Gain since birth, 6 oz.

General Condition.—*Emaciated,* undersized, fair color, good skin.
Stools.—Three normal a day.
Vomiting.—None.
Appetite.—Takes all her food.
Temperature, 98.6° F.
Sleep.—Good.
Chief Complaint.—Insufficient gain in weight.

Previous Food:

Milk	12 oz., 240 cals.	Fed 3 oz. every 2 hours, 10 feedings in 24 hours.
Water	18 oz.	
Dextri-maltose.	½ oz., 60 cals.	

Total calories given 300, or 43 per pound. The caloric need is 60 calories per pound, because the infant is emaciated.

It is very evident that this infant could not possibly gain on 43 calories per pound, and, in order to fulfil the caloric requirements, more milk and sugar must be given. There was no vomiting and the stools were normal, so that with no contra-indications to increasing either the sugar or the milk (if done gradually) one more ounce of milk was added each day, giving one ounce less of water, until the 24-hour amount of food was 15 oz. milk and 15 oz. water boiled. This would give 300 calories of milk. At the end of that time the sugar was to be increased ¼ oz. every third day until 1 ounce (120 calories) of sugar was taken in twenty-four hours. The total number of calories would then be 420 ($300 + 120 = 420$), and as the infant then weighed almost 7 lb. this would give 60 calories per pound.

June 30, 21 days later: Weight, 8 lb.
Gain, 1 lb. 1 oz.

General Condition.—Much improved.
Stools.—Two normal a day.
Vomiting.—None.
Appetite.—Still hungry.
Sleep.—Good.

The weight had increased to 8 lb. and the infant was still receiving 420 calories of food, making only 52½ calories per pound per day. As the infant was still emaciated, although to a lesser degree, she needed 60 calories per pound, or 480 calories per day ($8 \times 60 = 480$).

As she was getting the maximum amount of sugar for her weight (1 oz. for infants under 10 lb.) the increase had to be made in the form of milk.

Treatment.—Food prescribed:

Milk	18 oz.,	boiled	360 cals.	Divide into 7 feedings of 3½+ oz. each. Feed every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M. and 2 A.M.
Water	18 oz.			
Dextri-maltose..	1 oz.,		120 cals.	

Total calories 480, or 60 per pound.

July 7, 7 days later: Weight, 8 lb. 8 oz.
Gain, 8 oz.

General Condition.—Much improved.
Stools.—Two normal per day.
Vomiting.—None.
Appetite.—Good.
Sleep.—Good.

At the present weight, with the food prescribed at the last visit, the infant is getting 56 calories per pound per day ($480 \div 8.5 = 56$). With this gain of weight (1 lb. 9 oz.) since July 9, she was no longer emaciated and might be classed as moderately thin, therefore needing 50 to 55 calories per pound.

As she was already getting 56 calories per pound it was not necessary to change the food until a further gain in weight was made and the number of calories per pound per day dropped below this mark.

July 29, three weeks later: Weight, 10 lb.
Gain, 1 lb. 8 oz.

General Condition.—Well nourished, good musculature.
Stools.—Two or three normal stools per day.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.

The infant is now over 4 months of age and, although short in stature, is well nourished and needs only 50 to 55 calories per pound per day. Since the food has not been changed with her increase in weight, she is getting 48 calories per pound ($480 \div 10 = 48$). She therefore needs more food, which may be given in the form of sugar (as she weighs 10 lb. and can be allowed 1½ oz. of sugar in 24 hours).

Treatment.—Food prescribed:

Milk ..... 18 oz.	boiled	180 cals.	Divide into 7 feedings of 5+ oz. each.
Water ..... 18 oz.			Feed at 6, 9, 12 A.M., 3, 6, 10 P.M.,
Sugar .....1½ oz.		360 cals.	and 2 A.M.

Total calories 540, or 54 calories per pound.

September 1, four weeks later: Weight, 12 lb. 5 oz.
Gain, 2 lb. 5 oz.

General Condition.—Fat.
Stools.—One or two normal a day.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Fair.

Since the food has not been changed for over four weeks and the infant has been constantly gaining in weight, the number of calories per pound per day has dropped from 54 to 45. It would be a question whether she was fat enough to gain on 45 calories per pound or not (according to our table of caloric requirements).

(540 cals. ÷ 12 lb. = 45 cals. per pound per day.)

However, she has not gained as rapidly in the last week, is still very small for her age (though fat), and shows signs of hunger by crying. Taking these facts in consideration, we should still give 50 calories per pound per day. Since she cannot have any more sugar, it is necessary to make the increase in the form of milk. As 620 calories of food will be required ($12.4 \times 50 = 620$) and 180 calories of that will be sugar, it will leave 440 calories ($620 - 180 = 440$) or 22 ounces ($440 \div 20 = 22$) to be supplied in milk.

Treatment.—Food prescribed:

Milk ..... 22 oz.,	boiled	440 cals.	Divide into 6 feedings. Feed 6 oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M.
Water ... 20 oz.			
Sugar ....$1\frac{1}{2}$ oz.,		180 cals.	

Total calories 620, or 50 calories per pound.

The physician frequently sees an infant that is so irregularly fed that it is impossible to determine how much actual food is being given during the twenty-four hours, making it quite impossible for him to determine the caloric value of the twenty-four-hour amount of food consumed.

The following case illustrates very well this phase of infant feeding:

Case IX

(Case illustrating the necessity of an accurate and routine method of mixing and administering the food)

September 30: Male, age 2 months.

Birth weight, 6 lb. 8 oz.
Present weight, 7 lb. 13 oz.
Gain since birth, 1 lb. 5 oz.

General Condition.—Excellent.
Stools.—Two normal with cathartic.
Vomiting.—None.
Appetite.—Good, takes all the food.
Temperature, 98.6° F.
Sleep.—Good.
Chief Complaint.—Fretful and not gaining in weight.

Previous Food:

Milk .... 1 cup	unboiled	The barley was boiled for five minutes, then the milk was poured into the gruel and brought to a boil. Food was made two or three times in 24 hours, or whenever more food was needed. *4 to 6 oz. (as much as the baby would take) was given once in two to four hours or whenever the baby cried.*
Water .... 2 cups		
Barley .... 1 tablespoonful		
Cane sugar .... 1 tablespoonful		

It is impossible to reckon the calories in this food, because the size of the cups is not known, and it is also impossible to ascertain the quantity of food taken in twenty-four hours.

Treatment.—The mother was instructed to buy a cheap glass graduate and to purchase at least 7 nursing bottles, marked off in ounces (when it is not possible to purchase graduates, the ingredients of the food may be measured in the nursing bottles), and two or three nipples. She was told to make the food at the same time each day in the following manner:

Milk	16 oz.,	boiled	320 cals.	Divide into 7 feedings. Feed 4+ oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water	16 oz.	boiled		
Cane sugar .. (2 level tablespoonfuls)	1 oz.,		120 cals.	

Total calories 440, or 55 calories per pound.

The infant did well upon these feedings and gained continuously in weight as the food was increased in proportion to the gain in weight.

Mothers are usually glad of suggestions. They realize that their work is made much easier for them by doing things upon a schedule, and that the entire care of the infant is lessened thereby. Even among dispensary patients it is rare to meet with any objection to such a plan of treatment.

The feeding of the new-born infant from birth and throughout the first two weeks of life has been described elsewhere (see page 87). As has been said there, at two or three weeks of age the average infant's formula would have been gradually increased to fifteen ounces of milk, fifteen ounces of water and one ounce of sugar (four level tablespoonfuls of malt sugar, three tablespoonfuls of milk sugar or two tablespoonfuls of cane sugar). An infant of this age will weigh seven or eight pounds. In this formula there are 300 calories of milk and 120 calories of sugar, 420 calories in all. An eight-pound infant would, therefore, receive fifty-two calories per pound per day, and a seven-pound infant would be getting sixty calories per pound per day. In either case this formula fulfils the caloric requirements, because a seven-pound infant of two weeks of age is usually not a fat infant and needs sixty calories per pound, while an eight-pound infant of this age is fairly well nourished and would gain very nicely on fifty to fifty-five calories per pound per day.

As the infant grows and gains in weight, the milk and

water should be increased an ounce at a time, always keeping the food equal parts of milk and water up to twenty ounces of each. That is, the next change would be sixteen ounces of water and one ounce of sugar, then seventeen ounces of milk, seventeen ounces of water and one ounce of sugar and so on up to twenty ounces of milk, twenty ounces of water and one ounce of sugar.

The sugar should not be increased above one ounce a day until the infant has reached ten pounds in weight (see page 66), when it may be gradually increased to one and a half ounces for the total twenty-four-hour amount of food. With the increase in sugar the formula will be twenty ounces of milk, twenty ounces of water and one and a half ounces of sugar.

If we now take account of calories we find that there are 400 calories of milk and 180 calories of sugar, making 580 calories in all, which for a ten-pound baby would give 58 calories per pound per day, or for an eleven-pound baby about 53 calories per pound per day. This as a rule works out very nicely, because if the baby is fat and well nourished he will need only 53 calories, while if he is thinner he would need the 58 calories. (See page 70.)

In the meantime, the total amount of food has always been equally divided into seven bottles, fed at six, nine and twelve A.M. and three, six and ten P.M. and two A.M. After the baby has reached twelve pounds in weight, the two A.M. feeding may be discontinued and the total amount of food divided evenly into six bottles.

Later, when the infant has again increased in weight, and therefore requires more food to fulfil the caloric requirements, it is necessary to begin increasing the food once more. The food can now be made stronger than half milk and half water, because the infant is over twelve pounds in weight and is three or four months of age (see page 74). From now on the milk should be increased without increasing

the water, and the next change therefore would be to twenty-two ounces of milk, twenty ounces of water and one and a half ounces of sugar divided evenly into six bottles. This change suffices for a time until the infant has gained sufficiently in weight to the point where this amount of food does not fulfil the caloric requirements. Then, still increasing the milk without increasing the water, we get up to twenty-four ounces of milk, twenty of water and one and a half ounces of sugar. The next change would be twenty-six ounces of milk, twenty ounces of water and one and a half ounces of sugar, the next change twenty-eight ounces of milk, twenty ounces of water and one and a half ounces of sugar. Again taking account of the calories we have 560 calories of milk, 180 calories of sugar, making 740 calories in all. Thus a fifteen-pound baby would get about fifty calories per pound or a sixteen and a half pound baby forty-five calories per pound. The infant, which would probably be about six months of age, would need fifty calories if it weighed fifteen pounds, but if it were fat and weighed between sixteen and seventeen pounds forty-five calories would be ample.

Before a further increase is necessary, it is best to cut down the number of feedings to five in the twenty-four hours, and start upon a four-hour schedule, the feedings coming at 6 and 10 A.M., 2, 6 and 10 P.M. If we were to divide the twenty-eight ounces of milk and twenty ounces of water evenly into five feedings, it would give us nearly ten ounces in each bottle, which is usually too much, so that it is now found practicable to give a stronger dilution by cutting down the water and not giving more than eight ounces at a feeding. Allowing for the food's decrease in volume by the active boiling of three minutes, we will get eight ounces at a feeding by using the following formula: milk twenty-eight ounces, water fourteen ounces, sugar one and a half ounces.

From now on the water should be decreased as the milk is increased, making an even stronger dilution. As the infant is presumably seven or eight months of age by this time and the weight has increased up to seventeen or eighteen pounds, the next change in the formula would be to thirty ounces of milk, twelve ounces of water and one and a half ounces of sugar. Still later increase the milk to thirty-two ounces, water ten ounces and sugar one and one-half ounces. We are now giving a full quart of milk in twenty-four hours and that is as much milk as any normal infant needs. If we again take account of the calories, the thirty-two ounces of milk equals 640 and the one and one-half ounces of sugar 180 calories, making a total of 820 calories in the day's food. With this mixture an eighteen-pound baby would be getting forty-five calories per pound per day.

From now on we must add other foods besides milk and sugar, when it becomes necessary to increase the number of calories as the infant increases in weight. Barley gruel should be used as the diluent instead of water, if the infant is under six and one-half months of age, which is rare indeed. After this age the number of calories may be increased by giving breadstuffs, cereals and gruels in addition to the bottle feedings. The cereals and gruels should be fed with a spoon, and the breadstuffs given dry in the hand so that the infant may learn to eat, and should be varied from day to day, so that the infant will like a variety of food. They should never be given between feedings, but immediately before a bottle feeding. After the infant has become accustomed to eating these foods, it is time to change gradually to a diet of undiluted milk and cereals, as shown on page 349, in Case LXXX.

All through this feeding period it is the author's custom to boil the milk. He has found that so many babies have digestive disturbances when it is attempted to stop boiling the milk, and things go along so smoothly when the boiled

milk is used throughout the bottle period, that there is seldom any reason for attempting to change to raw milk.

Orange juice should be given to the normal bottle-fed infant at six weeks to two months of age, beginning with a teaspoonful once a day, one hour before a feeding, preferably at 8 A.M. If the orange juice agrees, it should be increased a teaspoonful each week. That is, the second week two teaspoonfuls should be given each day at 8 A.M. and the third week three teaspoonfuls, and so on, until in two or three months the juice of a whole orange is given once a day an hour before a feeding. When orange juice was first used as a routine with boiled milk mixtures, all it was meant to do was to prevent scurvy. In the author's opinion there is no question but that it does a great deal more than this. In case after case it has been observed that the infants that take a lot of orange juice and take it well are the infants who thrive the best. They gain faster, the color of the cheeks, mucous membranes and lips is rosier, the muscles and the flesh are firmer, the skin more smooth and velvety, the hair silky and the bones well shaped. Infants who do not take orange juice well and in large quantities are less apt, as time goes on, to present this healthful appearance. It is true that all babies do not take orange juice well, and with those who do not it is necessary to proceed very cautiously in increasing the amount. Occasionally infants have loose undigested stools when orange juice is given, or have colic or vomiting. Such infants are by far in the minority and they are usually difficult infants to feed. The author has seldom found that any other antiscorbutics are better borne, but potato water or the juice from canned tomatoes may be tried when orange juice seems to disagree.

A Rough Rule to Take the Place of Reckoning Calories

It will be seen from the preceding pages on calories that an infant requires a definite number of ounces of milk every

day for each pound of body weight, to which is added one or one and a half ounces of sugar. This milk and sugar must be diluted with water. A rough rule for estimating the quantity of cow's milk that an infant needs is as follows: *The average infant having no digestive disturbances requires in twenty-four hours twice as many ounces of milk as it weighs in pounds, provided it can take one or one and a half ounces of sugar.* Fat, well-nourished infants, older than four months, need less than this, while emaciated infants often need much more. For an illustration, take an infant weighing 10 pounds; this infant would require 20 ounces of milk (since, according to the rule, it needs twice as many ounces of milk as it weighs in pounds) and perhaps 20 ounces of water, and if an ounce of sugar were added to this, it would give 520 calories ($20 \times 20 = 400$; $400 + 120 = 520$). This infant would then be getting 52 calories per pound ($520 \div 10 = 52$). This is about the caloric requirement for the average infant under four months of age. This rule, it must be remembered, applies to the *well* infant only. It would be disastrous to give an infant who has diarrhœa, vomiting, or other digestive disturbances the prescribed number of calories of milk and sugar, though it cannot be expected to gain in weight until the required amount can be given. When there are such digestive disturbances, food which may not so well fill the infant's caloric requirements must be used temporarily. The reasons for this and the proper method of gradually increasing the milk and sugar are discussed fully in the following chapter.

CHAPTER VI

CONDITIONS UNDER WHICH THE CALORIC REQUIREMENTS SHOULD NOT BE FULFILLED

One of the first principles of caloric feeding is *not* to fulfil the caloric requirements in certain classes of infants. Those who are opposed to caloric infant feeding do not seem to realize this, and base their criticism upon the supposition that *all* infants at *all* times are fed according to their actual caloric needs.

Usually it is extremely harmful to start an infant with a food of the full strength, and to give the required amount of milk and sugar to make up the number of calories which we know must eventually be given to make the infant gain in weight and develop properly. For instance, an infant comes for treatment who is to be fed artificially for the first time, perhaps through a sudden cessation of the breast milk. We would have a very sick infant on our hands if we attempted immediately to fill its caloric requirements. There are certain indications for increasing an infant's tolerance before the caloric needs can be fulfilled.

The caloric requirements should not be fulfilled under the following conditions:

(1) In the new-born (for the first two weeks).

(2) Normal infants abruptly weaned from the breast (until their tolerance for food can be gradually increased).

(3) Infants whose previous food has not contained cow's milk (until the milk and sugar can be gradually increased).

(4) Infants who have been overfed (until their digestive apparatus has had a chance to recuperate).

(5) Infants who have been underfed (until their tolerance for food has been gradually increased).

(6) Infants who have diarrhœa or who have recently recovered from diarrhœa (until the stools have become normal and the tolerance for food has been gradually increased).

(7) Infants who have excessive vomiting or have recently recovered from excessive vomiting (until vomiting has stopped and the tolerance for food increased).

(8) Infants with loss of appetite (until all food is greedily taken).

(9) Infants who are partially breast fed (until they are entirely weaned, because it is impossible to determine how many calories they are getting from the breast).

New-born Infants

Occasionally an infant has to be bottle-fed from birth through the sudden death or illness of the mother, or through the certainty that the mother cannot supply sufficient milk to nourish it (see Breast Feeding, page 244). When such an occasion arises, it is most essential to avoid giving too strong a food during the first, second, and third weeks of life. Considering the fact that many breast-fed infants do not show a gain in weight during the first ten days or two weeks of life, bottle-fed infants should not be expected to do any better. Begin, therefore, on weak foods which do not come up to the caloric requirements; and increase the tolerance by gradually increasing the strength of the food until the infant is getting enough milk and sugar in twenty-four hours to fill its caloric requirements and to permit of a gain.

For the first week, twenty ounces of food may be mixed each day, offering the infant three ounces every three hours (seven feedings in twenty-four hours). At first less than an ounce will be taken at a time, but the infant is allowed all that it will take of three ounces, the remainder being thrown away. This food should be made one-quarter milk and three-quarters water,—that is, five ounces of milk and fifteen

ounces of water. The milk and water should be boiled together during the first month if not throughout infancy. No sugar should be added until the stools have become firm and smooth and yellow, showing no traces of mucus.

At the end of four or five days, or when the infant takes all of the three ounces offered, begin to increase the strength of the food. This is accomplished by adding an ounce more of milk each day, or on alternate days, allowing the amount of water to remain stationary. The first day of the increase, six ounces of milk are added to the fifteen ounces of water; the next day seven ounces of milk to fifteen ounces of water, and so on. With this increase in the strength of the mixture the milk is gradually changed from one-quarter to one-third milk in proportion to the amount of water, and by the end of the second week, if the milk is increased one ounce each day, the infant will be getting half milk and half water, or fifteen ounces of milk and fifteen ounces of water. This is as strong a dilution as it is advisable to give an infant under three or four months of age.

The quantity given at each feeding is at the same time being gradually increased, since the whole amount of food made each day is divided into seven bottles. When the half-and-half mixture has been reached (fifteen ounces of milk and fifteen ounces of water) there will be a little over four ounces in each bottle, some of the water being boiled away.

In the meantime the sugar has been added and gradually increased in the following manner: when the meconium has disappeared and the stools have become firm, smooth, yellow, and free of mucus, one level tablespoonful of sugar (levelled with a knife) is added to the whole twenty-four-hour amount of food. If, after three or four days, the stools remain firm with this amount of sugar, two level tablespoonfuls are used. Three or four days later the sugar is again increased by one level tablespoonful and so on up to one ounce of sugar in twenty-four hours, which is as much as any

infant under ten pounds in weight should receive. In increasing the sugar, always be guided by the bowels. If they become in the least loose or show signs of indigestion, it is better not to further increase the sugar until these signs have disappeared. If there is constipation, the sugar may be increased a teaspoonful each day, avoiding cathartics and giving an enema once in twenty-four hours if the bowels will not move without it.

This method of feeding may be used at any time during the first two or three weeks of life if bottle feedings have to be instituted.

CASE X

Owing to the fact that three previous children of this mother had suffered a severe initial loss in weight and strength, through the unsuccessful endeavor to feed from her breast, it was decided, even before the birth of this infant, to give artificial feedings from the start. Under the most ideal conditions as to diet, rest and good health, the mother had had almost no breast milk after the three former confinements.

November 20: Age, 1 day. Weight, 6 lb. 12 oz.

General Condition.—That of a small new-born infant somewhat under the average.
Stools.—Meconium.
Vomiting.—None.
Appetite.—Takes nipple well.
Sleep.—Good.

Treatment.—Food prescribed:

Milk .... 5 oz. } boiled (100 cals.)
Water ..... 15 oz. }
Sugar....... 0

Divide into 7 feedings. Feed 1 to 2 oz. every 3 hours, at 6, 9, 12 A.M., 3, 6, 10 P.M., 2 A.M.

November 21 (1 day later): Age, 2 days. Weight, 6 lb. 9 oz. Loss, 3 oz.

General Condition as at the last visit.
Stools.—Meconium.
Vomiting.—None.
Appetite.—Takes ½ to ¾ oz. at a feeding.
Sleep.—Good.

Treatment.—Food prescribed:

Milk ...... 5 oz. } boiled (100 cals.)
Water ..... 15 oz. }
Sugar 0

Divide into 7 feedings. Feed 1 to 3 oz. every 3 hours, at 6, 9, 12 A.M., 3, 6, 10 P.M., 2 A.M.

November 24 (3 days later): Age, 5 days. Weight, 6 lb. 9 oz.

General Condition.—Good.
Stools.—Three firm, no mucus.
Vomiting.—None.
Appetite.—Takes whole 3 oz. at each feeding.
Sleep.—Good.

Treatment.—Food prescribed: Increase the milk 1 oz. each day up to:

Milk	8 oz.	boiled	(160 cals.)	Divide into 7 feedings. Feed 3 oz. every 3 hours, at 6, 9, 12 A.M., 3, 6, 10 P.M., 2 A.M.
Water	15 oz.	boiled		
Dextri-maltose...	¼ oz.		(30 cals.)	

Total number of calories 190, or 30 calories per pound. Caloric requirements, 55 per pound.

November 27 (3 days later): Age, 8 days. Weight, 6 lb. 11 oz.
Gain, 2 oz.

General Condition.—Good.
Stools.—Three normal, except for small amount of mucus.
Vomiting.—None.
Appetite.—Satisfied, takes all the food.
Sleep.—Poor at night

Treatment.—Food prescribed: Increase the milk 1 oz. each day up to:

Milk	12 oz.	boiled	(240 cals.)	Divide into 7 feedings of 3½ oz. Feed at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water	15 oz.	boiled		
Dextri-maltose ..	¼ oz.		(30 cals.)	

Total number of calories 270, or 40 calories per pound.

December 2 (5 days later): Age, 13 days. Weight, 6 lb. 11 oz.
No gain.

General Condition.—Good.
Stools.—Two normal.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	14 oz.	boiled	(280 cals.)	Divide into 7 feedings of 4 oz. each. Feed as before.
Water	15 oz.	boiled		
Dextri-maltose ...	¼ oz.		(30 cals.)	

Total number of calories 310, or 45 calories per pound.

December 4 (2 days later): Age, 15 days. Weight, 7 lb.
Gain, 5 oz.

General Condition.—Good.
Stools.—Two hard, dry, yellow, homogeneous.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	15 oz.	boiled	(300 cals.)	Divide into 7 feedings of 4+ oz. each. Feed as before.
Water	15 oz.	boiled		
Dextri-maltose ..	½ oz.		(60 cals.)	

Total number of calories 360, or 51+ calories per pound.

December 7 (3 days later): Age, 18 days. Weight, 7 lb. 2 oz.
Gain, 2 oz.

General Condition.—Good.
Stools.—Two normal.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	15 oz.	boiled	(300 cals.)	Divide into 7 feedings of 4+ oz. each. Feed as before.
Water	15 oz.	boiled		
Dextri-maltose ..	¾ oz.		(90 cals.)	

Total number of calories 390, or 56– calories per pound.

December 12 (5 days later): Age, 23 days. Weight, 7 lb. 8 oz.
Gain, 6 oz.

General Condition.—Good.
Stools.—Two normal.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	15 oz.	boiled	(300 cals.)	Divide and feed as before.
Water	15 oz.	boiled		
Dextri-maltose ...	1 oz.		(120 cals.)	

Total number of calories 420, or 56 calories per pound.

December 20 (8 days later): Age, 1 month. Weight, 8 lb.
Gain, 8 oz.

General Condition.—Good.
Stools.—Two normal.
Vomiting.—None.
Appetite.—Satisfied.
Sleep.—Good.

Case XI

(Illustrating the method of feeding an infant three days old)

May 23: Age, 3 days. Birth weight, 7 lb. 7 oz.
Present weight, 7 lb.
Loss since birth, 7 oz.

General Condition.—Well nourished, normal in every way.
Stools.—Meconium just disappearing and stools beginning to get green and watery, with some mucus, owing to underfeeding during the first days of life.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.

Previous Food.—Has been put to the breast once in four hours since birth. On the third day, through illness of the mother, it was found necessary to give artificial feeding.

Treatment.—Food prescribed:

Milk	5 oz.	boiled	(100 cals.)	Divide into 7 feedings of 3 oz. each. Feed 1 to 3 oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water	15 oz.	boiled		
Sugar......	0			

May 25 (2 days later): Age, 5 days. Weight, 7 lb. No gain or loss.

General Condition.—The same.
Stools.—Three yellow and smooth daily, with no mucus or curds.
Vomiting.—None.
Appetite.—Hungry; takes 3 oz. at a feeding.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	6 oz.	boiled	(120 cals.)	Divide into 7 feedings and feed as before.
Water	15 oz.	boiled		
Sugar......	0			

The milk was to be increased one ounce each day and dextri-maltose added a tablespoonful more every third day so that by June 3, when the infant was fifteen days old, the formula was as follows:

Milk	15 oz.	boiled	(300 cals.)	Divide into 7 feedings and feed as before.
Water	15 oz.	boiled		
Dextri-maltose...	½ oz.		(60 cals.)	

Total calories 360, or 51 calories per pound. Caloric requirements, 55 per pound.

June 3 (7 days later): Age, 15 days. Weight, 7 lb. 6 oz. Gain, 6 oz.

General Condition.—Excellent.
Stools.—Two soft, smooth, yellow.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	15 oz.	boiled	(300 cals.)	Divide into 7 feedings and feed as before.
Water	15 oz.	boiled		
Dextri-maltose...	¾ oz.		(90 cals.)	

Total number of calories 390, or 52 per pound.

June 10 (7 days later): Age, 21 days. Weight, 7 lb. 10 oz.
Gain, 4 oz.

General Condition.—As at last date.
Stools.—Two yellow, smooth, with no mucus or curds.
Vomiting.—None.
Appetite.—Takes all the food.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	15 oz.	boiled	(300 cals.)	Divide into 7 feedings and feed as before.
Water	15 oz.	boiled		
Dextri-maltose...	1 oz.		(120 cals.)	

Total number of calories 420, or 55 calories per pound.

The caloric requirements now being filled, the infant continued to gain in weight as the food was increased, and at seven months of age the weight was 20 pounds. The milk was boiled during the first six weeks, after which it was changed to raw milk mixtures without any digestive disturbance.

Normal Infant Abruptly Weaned from the Breast

It occasionally happens that a normal, healthy infant must be abruptly weaned from the breast on account of the mother's ill-health or death, or for some other unavoidable reason. No matter what the age of the infant when bottle feeding is begun, a food much weaker than is sufficient to supply the infant's caloric requirements must be used at first. Older infants may have the food increased more rapidly than younger ones, but it is advisable at any age to begin with one-third milk and two-thirds water, and with a very small amount of sugar. It is also preferable to boil the milk for the first few weeks. Infants who have never had any cow's milk will usually stand boiled milk better at first, and the strength of the food can be increased more rapidly than with raw milk.

Case XII

(Illustrating abrupt weaning of an infant on account of mother's sudden death)

January 28: Age, 2 months. Birth weight, 6 lb. 8 oz.
Present weight, 9 lb. 14 oz.
Gain since birth, 3 lb. 6 oz.

General Condition.—Excellent; fat, well nourished, normal in every way.
Stools.—Two normal a day.
Vomiting.—None.
Appetite.—Normal.
Sleep.—Good.

Previous Food.—Has never had anything but breast milk, which was given every 3 hours, 7 feedings in 24 hours, until the sudden death of the mother the night before.

Treatment.—Food prescribed:

Milk	10 oz.	boiled	(200 cals.)	Divide into 7 feedings of 4+ oz. each. Feed every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water	20 oz.	boiled		
Cane sugar	¼ oz.		(30 cals.)	

Total number of calories 230, or approximately 23 calories per pound.

Increase the milk and decrease the water one ounce each day up to 15 oz. of milk and 15 oz. of water.

February 1 (4 days later): Weight, 9 lb. 15 oz.
Gain, 1 oz.

General Condition.—Excellent.
Stools.—One soft, yellow, normal.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	15 oz.	boiled	(300 cals.)	Divide and feed as before.
Water	15 oz.	boiled		
Cane sugar	½ oz.		(60 cals.)	

Total number of calories 360, or approximately 36 calories per pound.

February 7 (6 days later): Weight, 10 lb. 2 oz.
Gain, 3 oz.

General Condition.—Excellent.
Stools.—Normal.
Vomiting.—None.
Appetite.—Still hungry.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	18 oz.	boiled	(360 cals.)	Divide and feed as before (5+ oz. at each feeding).
Water	18 oz.	boiled		
Cane sugar	¾ oz.		(90 cals.)	

Total number of calories 450, or 44+ calories per pound.

February 11 (4 days later): Weight, 10 lb. 4 oz.
Gain, 2 oz.

General Condition.—Excellent.
Stools.—Normal.
Vomiting.—None.
Appetite.—Good.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	20 oz.	boiled	(400 cals.)	Divide and feed as before
Water	20 oz.	boiled		($5\frac{1}{2}$ oz. at each feeding).
Cane sugar	1 oz.		(120 cals.)	

Total number of calories 520, or 50+ calories per pound.

February 22 (11 days later): Weight, 10 lb. 12 oz.
Gain, 8 oz.

General Condition.—Excellent.
Stools.—Normal.
Vomiting.—None.
Appetite.—Good.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	20 oz.	boiled	(400 cals.)	Divide and feed as before.
Water	20 oz.	boiled		
Cane sugar	$1\frac{1}{2}$ oz.		(180 cals.)	

Total number of calories 580, or 54– calories per pound.

Infants Whose Previous Food Has Not Contained Fresh Cow's Milk

An infant who has previously been fed upon an artificial food not containing fresh cow's milk should at first be started with small quantities of milk. For a few days or weeks, or until the infant has become accustomed to milk feedings, it is well to boil this mixture of milk and water. The amount of sugar that is first added to the food should depend upon the condition of the infant's digestive apparatus, as well as upon the quantity of sugar that the previous food has contained. For instance, the ordinary brand of condensed milk contains over 50 per cent. sugar. When an infant has been fed with condensed milk if this large quantity of sugar has not already caused digestive disturbances, it is safe when changing to a cow's milk formula to begin feeding such an infant with sugar at once, although it is

advisable to start with less than an ounce. In Case XIII it may be seen that the infant was started with a fairly weak dilution, and that for a few days at least very small quantities of sugar were used.

CASE XIII

(Illustrating the institution of fresh cow's milk feedings with a poorly nourished infant previously fed upon condensed milk)

August 12: Age, 4½ months. Birth weight, 9 lb.
Present weight, 11 lb. 5 oz.
Gain since birth, 2 lb. 5 oz.

General Condition.—Pale, poorly nourished, undersized, skin slightly wrinkled.
Stools.—One normal a day.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Cries a great deal during the day; sleeps fairly well at night, though restless.
Temperature, 98.6° F.
Chief Complaint.—Insufficient gain in weight.

Previous Food.—Breast-fed the first 6 weeks of life; since then has had:

Condensed milk	3 teaspoonfuls	Fed 6 oz. every 2 hours, 10 or 11
Water	6 oz.	feedings in 24 hours.

Treatment.—Food prescribed:

Milk	15 oz.	boiled	(300 cals.)	Divide into 7 feedings. Feed
Water	25 oz.	boiled		6- oz. every 3 hours at 6, 9,
Cane sugar......	½ oz.		(60 cals.)	12 A.M., 3, 6, 10 P.M., and 2 A.M.

Total number of calories 360, or 32 calories per pound. Caloric requirements, 55 per pound.

August 17 (5 days later): Weight, 11 lb. 6 oz.
Gain, 1 oz.

General Condition.—The same.
Stools.—Two normal a day.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Still cries a great deal in the daytime.

Treatment.—Food prescribed:

Milk	20 oz.	boiled	(400 cals.)	Divide into 7 feedings and
Water	22 oz.	boiled		feed as before (6 oz. at
Cane sugar	¾ oz.		(90 cals.)	each feeding).

Total number of calories 490, or 43+ calories per pound.

August 20 (3 days later): Weight, 11 lb. 7 oz.
Gain, 1 oz.

General Condition.—As before.
Stools.—One or two normal a day.
Vomiting.—None.
Appetite.—Still hungry.
Sleep.—Better, but still cries a great deal.

Treatment.—Food prescribed:

Milk	22 oz.	boiled	(440 cals.)	Divide and feed as before.
Water	20 oz.	boiled		
Cane sugar	1 oz.		(120 cals.)	

Total number of calories 560, or 50– calories per pound.

August 27 (7 days later): Weight, 11 lb. 12 oz.
Gain, 5 oz.

General Condition.—Improved.
Stools.—One or two normal a day.
Vomiting.—None.
Appetite.—Good.
Sleep.—Much better.

Treatment.—Food prescribed:

Milk	22 oz.	boiled	(440 cals.)	Divide and feed as before.
Water	20 oz.	boiled		
Cane sugar	1½ oz.		(180 cals.)	

Total number of calories 620, or 53– calories per pound.

This infant continued to gain in weight and made a normal progress as the food was increased in strength.

Cane sugar was used because the infant had already become accustomed to the cane sugar in the condensed milk and had had no digestive disturbances. The milk was boiled for a time because the infant had never had raw milk feedings, and it was feared that unboiled milk might at first cause indigestion. The first mixture used was a little stronger than one-third milk, because of the infant's age and its extreme need of food.

Infants Who Have Been Overfed

It is not unusual for an infant to be overfed without giving rise to digestive symptoms. At the same time the infant may appear hungry, cry a great deal, and not gain properly in weight. The overfeeding may be in the form of too great a quantity; that is, the number of calories may be far in excess of its needs. Again, there are infants who, though they are getting the proper number of calories, are receiving one element of the food, such as fat or sugar, in excess.

Overfed infants who have not had digestive disturbances in spite of their bad feeding are usually very easy to control when a correct feeding is given, but it is always necessary to give (for a few days at least) a food which does not fulfil their caloric needs.

Case XIV

(Illustrating excessive sugar feeding as well as overfeeding in the number of calories)

November 10: Age, 4 months. Birth weight unknown.
Present weight, 13 lb.

General Condition.—Fat, large, normal.
Stools.—Three or four normal.
Vomiting.—None.
Appetite.—Appears hungry; takes all the food offered.
Sleep.—*Cries most of the day*, sleeps fairly well at night.
Temperature, 98.6° F.
Chief Complaint.—Crying and colic.

Previous Food:

Milk	28 oz.	not boiled.	(560 cals.)	Fed 6 oz. every 2 hours, 10 feedings in 24 hours.
Water	32 oz.			
Milk sugar	18 teaspoonfuls		(260 cals.)	
Lime water	3 oz.			

Total number of calories 820, or 63 calories per pound. The caloric needs are 50 calories per pound, or a total of 650 calories.

Treatment.—Food prescribed:

Milk	22 oz.	not boiled	(440 cals.)	Divide into 7 feedings. Feed 6 oz. every 3 hours, at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water	20 oz.			
Cane sugar	½ oz.		(60 cals.)	

Total number of calories 500, or 39+ calories per pound.

The total daily quantity is cut down to 42 ounces, the sugar is reduced to ½ ounce on account of the excessive amount in the previous food, and only 39 calories per pound are given, in order to give the gastro-intestinal tract less work for a few days. The milk was not boiled because the previous food being unboiled had not caused vomiting or bad stools in spite of excess of sugar, frequent feedings and high caloric content.

November 13 (3 days later): Weight, 13 lb.
No gain or loss.

General Condition.—Same as at the last visit.
Stools.—One or two normal a day.

Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good; cries little.

Treatment.—Food prescribed:

Milk	22 oz.	not boiled.	(440 cals.)	Divide into 6 feedings. Feed 6 oz. every 3 hours, at 6, 9, 12 A.M., and 3, 6, 10 P.M.
Water	20 oz.			
Cane sugar	1 oz.		(120 cals.)	

Total number of calories 560, or 43 calories per pound.

November 16 (3 days later): Weight, 13 lb. 2 oz.
Gain, 2 oz.

General Condition.—The same.
Stools.—One constipated.
Vomiting.—None.
Appetite.—Good.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	24 oz.	not boiled.	(480 cals.)	Divide and feed as before (6 + oz. at a feeding).
Water	20 oz.			
Cane sugar ...	1½ oz.		(180 cals.)	

Total number of calories 660, or 50– calories per pound.

November 24 (8 days later): Weight, 13 lb. 11 oz.
Gain, 9 oz.

General Condition.—Excellent.
Stools.—Two normal a day.
Vomiting.—None.
Appetite.—Satisfied.
Sleep.—Good.

A continuous gain in weight took place thereafter, the food being increased from time to time so that the caloric requirement might keep pace with the increase in weight.

Case XV

The following case shows an infant without digestive disturbances (except for mild constipation) who had been fed too concentrated a food from the first two months of life:

April 27: Age, 6½ months. Birth weight, 9 lb. 8 oz.
Present weight, 14 lb. 10 oz.
Gain since birth, 5 lb. 2 oz.

General Condition.—Markedly rhachitic, pale, and for the last three days has been having convulsions, three in all during this period. Fairly well nourished.
Stools.—One constipated, with the aid of milk of magnesia.
Vomiting.—At the time of convulsions only.

Appetite.—Appears hungry; takes all the food offered.
Temperature, 98.6 F.
Sleep.—Poor; cries a great deal.
Chief Complaint.—Convulsions.

Previous Food:

Milk	28 oz.	boiled.	(560 cals.)	Fed 7 oz. every 4 hours, 5 feedings in 24 hours.
Water	7 oz.	boiled.		
Cane sugar	$1\frac{1}{2}$ oz.		(180 cals.)	

Total number of calories 740, or 50− calories per pound.

Treatment.—Sodium bromide, 4 grs.; chloral hydrate, 1 gr., every 6 hours.

Food prescribed:

Milk	21 oz.	(420 cals.)	Divide into 6 feedings. Feed 7 oz. at 6, 9, 12 A.M., 3, 6, 10 P.M.
Water	21 oz.		
Dextri-maltose ...	$\frac{1}{2}$ oz.	(60 cals.)	

Total number of calories 480, or 32 calories per pound.

May 4 (7 days later): Weight, 14 lb. 8 oz.
Loss, 2 oz.

General Condition.—Brighter than at last visit; no convulsions.
Stools.—One a day with enema.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Better.

Treatment.—Food prescribed:

Milk	24 oz.	boiled.	(480 cals.)	Divide and feed as before (8 oz. at a feeding).
Water	24 oz.	boiled.		
Dextri-maltose ...	1 oz.		(120 cals.)	

Total number of calories 600, or 41+ calories per pound.

May 11 (7 days later): Weight, 14 lb. 11 oz.
Gain, 3 oz.

General Condition.—Improved; no convulsions
Stools.—Two normal a day.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	28 oz.	boiled.	(560 cals.)	Divide and feed as before.
Water	20 oz.	boiled.		
Dextri-maltose ..	$1\frac{1}{2}$ oz.		(180 cals.)	

Total number of calories 740, or approximately 50 calories per pound.

May 18 (7 days later): Weight, 15 lb. 5 oz.
Gain, 10 oz.

General Condition.—Improving; no convulsions.
Stools.—Two normal a day.
Vomiting.—None.
Appetite.—Good.
Sleep.—Good.

Infants Who Have Been Underfed

Overfeeding in the form of too much food or too strong food or too frequent feedings is an error that is commonly made by the laity, while the physician is more apt to err by underfeeding. The physician, with a profound respect for the digestive disturbances that may already exist, and fearful of causing more, is apt to delay too long in increasing the strength of the feeding.

The following case seen in consultation is an exaggerated example of underfeeding. The infants (twins) were vomiting slightly. At this time they were receiving only eighteen calories per pound in twenty-four hours, most of this being in the form of sugar. It was not possible for them to gain in weight, and the wonder is that they did not starve to death, considering that their caloric needs were sixty-five calories per pound, since they were emaciated babies. (See page 70.)

Case XVI

(An exaggerated case of underfeeding)

May 7 (twins): Age, 1 month. Birth weight (boy), 4 lb. 4 oz.
Present weight, 4 lb.
Loss since birth, 4 oz.
Birth weight (girl), 5 lb. 4 oz.
Present weight, 4 lb. 8 oz.
Loss since birth, 12 oz.

General Condition.—Emaciated, small, weak, feeble cry, fontanel and eyes sunken, skin wrinkled, pale.
Stools.—Small, watery, green stool with the aid of milk of magnesia each day.
Vomiting.—A little after each feeding.
Appetite.—Take all the food.
Sleep.—Good.
Chief Complaint.—Loss in weight.

Previous Food.—Breast milk had been given without success for one week only. For the next two weeks they had had:

Whole milk	1 oz.	(20 cals.)	Fed 2 oz. every 2 hours, 10 feedings in 24 hours.
Lime water	1 oz.		
Water	18 oz.		
Dextri-maltose	½ oz.	(60 cals.)	

Total number of calories 80, or 18 to 20 per pound. Caloric needs, 65 calories per pound.

Treatment.—Food prescribed for each infant:

Milk	7 oz.	boiled.	(140 cals.)	Divide into 10 feedings. Feed 2 oz. at 6, 8, 10, 12 A.M., 2, 4, 6, 8, 10 P.M., and 2 A.M.
Water	14 oz.	boiled.		
Dextri-maltose ...	¼ oz.		(30 cals.)	

Increase the milk one ounce every other day, allowing the amount of water to remain constant until the formula is half milk and half water. If there is no indigestion, gradually increase the sugar up to three-quarters of an ounce in twenty-four hours. At the end of two weeks the food will be:

Milk	14 oz.	boiled.	(280 cals.)	Divide and feed as before (3 oz. at a feeding).
Water	14 oz.	boiled.		
Dextri-maltose.	¾ oz.		(90 cals.)	

Total number of calories 370, or 65 calories per pound (allowing for a gain in weight during two weeks).

Frequent reports from the physician in charge showed a progressive gain in weight on this diet (the weight being doubled in less than three months) and a cessation of the vomiting. Later the food was increased to correspond with the increase in weight.

The next case is also one of underfeeding, but in a lesser degree. This infant was receiving 410 calories, or about 37 calories per pound, which is not extreme underfeeding, since the caloric needs were 50 to 55 calories per pound. Nevertheless, the food was deficient, and a gradual increase in the number of calories and a substitution of whole milk for the top milk used were needed.

Case XVII

(Illustrating a moderate case of underfeeding)

April 17: Age, 3½ months. Birth weight, 9 lb. 4 oz.
Present weight, 10 lb. 14 oz.
Gain since birth, 1 lb. 10 oz.

General Condition.—Fairly well nourished, undersized, pale, strong, and vigorous.
Stools.—Constipated; one or two a day with the aid of magnesia.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.
Chief Complaint.—Constipation, tendency to poor nourishment.

Previous Food.—Breast-fed for three weeks without satisfactory gain in weight; was then put upon Eskay's Food and milk mixture. Two weeks ago, because of lack of gain in weight, the following mixture was given by the physician in charge:

Top milk (8 per cent. fat)	12 oz.	(360 cals.)	Fed 4½ oz. every 2½ hours, 8 feedings in 24 hours.
Water	26 oz.		
Lime water	2 oz.		
Milk sugar	2 tablespoonfuls	(50 cals.)	

Total number of calories 410, or 37 per pound. Caloric needs, 550 calories, or 55 calories per pound.

Treatment.—Food prescribed:

Milk	15 oz.	boiled	(300 cals.)	Divide into 7 feedings. Feed 5 oz., at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water	20 oz.	boiled		
Dextri-maltose	½ oz.		(60 cals.)	

360 calories, or 38 calories per pound.

Increase the milk one ounce each day up to half milk and half water, always allowing the water to remain stationary. With the increase of milk each day the quantity at a feeding will, therefore, be increased. At the end of five days the food will be:

Milk	20 oz.	boiled	(400 cals.)
Water	20 oz.	boiled	
Dextri-maltose	½ oz.		(60 cals.)

460 calories, or 42 calories per pound.

The infant is still underfed, but it is well to increase the food slowly in this way, especially since the sugar was changed from milk sugar to malt sugar.

April 28 (11 days later): Weight, 11 lb. 1 oz.
Gain, 3 oz.

General Condition.—As before.
Stools.—One hard with the aid of milk of magnesia.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	20 oz.	boiled.	(400 cals.)	Divide into 7 feedings. Feed 6-oz. every 3 hours as before.
Water	20 oz.			
Dextri-maltose ...	$\frac{3}{4}$ oz.			
(In 3 days)	1 oz.		(120 cals.)	

520 calories, or 47 calories per pound.

May 3 (5 days later): Weight, 11 lb. 4 oz.
Gain, 3 oz.

General Condition.—As before.
Stools.—Normal.
Vomiting.—None.
Appetite.—Good.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	22 oz.	boiled	(440 cals.)	Divide and feed as before.
Water	20 oz.			
Dextri-maltose ...	$1\frac{1}{2}$ oz.		(180 cals.)	

620 calories, or 55 calories per pound.

May 10 (7 days later): Weight, 11 lb. 12 oz.
Gain, 8 oz.

General Condition.—Good.
Stools.—One or two normal.
Vomiting.—None.
Appetite.—Good.
Sleep.—Good.

This infant continued to do well, the food being strengthened as the weight increased and the calories kept at about 50 to 55 per pound.

CHAPTER VII

THE STOOLS

A MOTHER's or nurse's description of the stools should never be accepted unreservedly, but an inspection of them should be made at each visit. The following facts should be ascertained in every case of diarrhœa:

1. Duration of the diarrhœa.
2. Number of stools in 24 hours.
3. Size.
4. Color.
5. Consistency.
6. Odor.
7. Reaction.
8. Presence of mucus.
9. Presence of curds.
10. Presence of blood.
11. Whether cathartics have been administered or not.

Duration.—A diarrhœa that has lasted a long time is apt to be more difficult to overcome. When the bowels have reached a chronic state of irritation, the treatment must be influenced by this fact, and the prognosis is not as favorable. A diarrhœa of short duration, if caused by intestinal indigestion, is quickly amenable to proper treatment. This, however, is not true of acute infectious diarrhœa.

The Number of the Stools.—The normal number of stools varies. One a day is sufficient, although it is sometimes hard to convince a mother that this is true. Generally more than three or four may be considered pathological. The importance of the frequency of the stools has been much exaggerated. An infant may have marked intestinal indigestion with only three or four stools a day, and, on the other hand, there may be as many as three or four normal stools without intestinal indigestion. Some infants have three or more stools a day habitually all through the bottle period and thrive and gain in weight just the same as an infant who

has only one. When an infant whose habit it is to have one stool a day suddenly begins to have three or four, especially if their consistency is looser, or if they show other signs of indigestion, it should be looked upon as a warning that diarrhœa is imminent. When the stools are very numerous (ten to twenty or even more in twenty-four hours) it is most likely to be an indication of a severe type of diarrhœa. Frequent stools are also caused by an involvement of the colon, which has become so irritable that it will not retain the fecal matter as it comes from the upper bowel, even when the small intestines are doing their work well. The stools may be numerous, too, in an infant who is underfed, but they are always small in this case.

Size of the Stools.—The size of the stool may give a good deal of information when considered in conjunction with the number. The normal size of the stools is hard to estimate, since it depends almost entirely upon the food which the infant is taking. The infant fed on strong whole-milk mixtures which leave a great deal of residue will have a very large stool. An infant that is very much underfed may have only a slight staining of the diaper, although this may occur many times a day. Infants fed on malted milk or some of the proprietary foods which are given without cow's milk will also have small stools.

Color.—The color of the normal stool depends upon the food that is being taken. It is often possible to tell what food an infant is getting by examining the stools. An infant receiving barley or other cereals, or starches, will have a brown stool, and this will often be a very dark brown if the diet is entirely starch. Whole-milk mixtures will give stools of a very pale yellow color, often shading into a pale green, especially in an infant who has previously had a diarrhœa. This pale green color is considered normal with strong milk mixtures, provided there are no other abnormalities, such as curds and mucus, in the stool.

Although the color of the stool is not as significant as many of the other points of consideration, it figures largely in most descriptions of them. The first thing that the mother observes is that her baby's stools are "green." Many hospital records show a "green stool" recorded without further description. This is unfortunate, since a stool may be green yet firm, smooth, and normal in every other respect. A stool which has turned green after standing for some time is not pathological. An infant who has recently had an intestinal disturbance will very often have stools which are yellow when evacuated, but which, after remaining exposed to the air for a short time, turn green. In severe diarrhœa the green color is an indication that the food has passed rapidly through the bowels and that the bile has not had a chance to undergo a complete change, as it does when the intestinal digestion is normal.

Consistency.—The normal consistency of the stool also depends upon the food that is given. The proper consistency of the stool in an infant that is artificially fed should be about that of a good, stiff ointment, and should be of sufficient firmness to retain the round shape in which it comes from the rectum. The normal stool of a bottle-fed infant should also be homogeneous,—that is, smooth and all of the same quality. When pressed out in the diaper it should be smooth and glistening, as a good ointment or paste would be.

Frequently a stool is moistened with urine, and a normal stool in this state may appear to be loose. A stool which was watery when freshly passed sometimes appears dry because the watery elements of the stool have been absorbed by the diaper. The loose, watery stool derives its moisture from the fluid taken with the food or from an abnormal amount of intestinal secretion. Usually the looser the stool the more severe is the diarrhœa, other things being equal. The loose stool may also be foamy, but unless seen when

freshly passed this characteristic will not be observed. The foamy condition is probably due to fermentation of the carbohydrates. Following a diarrhœa, the hard, dry, or even crumbly stool of constipation has no particular significance, since constipation is always welcome after diarrhœa.

Odor.—A sour odor is due to fermentation of the carbohydrates within the intestinal canal. This does not necessarily mean that sugar is being given in too great excess, nor that it is the entire cause of the diarrhœa. The fat may be the original cause of the indigestion and the sugar fermentation a later development. On the other hand, sour-smelling stools are not an invariable accompaniment of fermentative diarrhœa. A foul, putrefactive odor like that of decayed meat indicates a putrefactive diarrhœa.

Reaction.—The reaction of a stool is of very little importance except in case of diarrhœa or in infants who have recently recovered from diarrhœa. In getting the reaction, a fresh stool, uncontaminated by urine, must be used since urine is usually acid. As it is often difficult for the physician to see a stool just as soon as it is passed, he must use either a catheter, suppository, or a glass tube with a hole blown in the side, inserted in the rectum. The reaction of the stools is dependent upon the following factors: First, the relative proportion of carbohydrate and protein ingested in the food, second the degree of fermentation or putrefaction taking place within the intestinal tract. A diet rich in carbohydrates with a minimum of protein produces an intestinal media favorable to fermentation and acid production. Peristalsis is thus increased and the stool is acid in reaction. With a food containing relatively large quantities of protein in the form of calcium caseinate, and little carbohydrate, putrefaction predominates with the formation of end products of alkaline reaction, therefore, the reaction is alkaline if putrefaction predominates and acid if there is fermentation or a fatty acid formation.

Curds.—Curds do not appear in the normal stool. There are three main varieties of curds, namely, caseine curds, fat curds and normal fecal masses wrapped in mucus. The caseine curds are about the size, shape and consistency of an uncooked lima bean. They occur only when raw cow's milk mixtures are given and are made to disappear by the simple expedient of boiling the milk. Fat curds are usually smaller. They are composed chiefly of calcium soaps and are soft and smooth and mash easily instead of being tough and stringy as the bean-like caseine curd. In bottle-fed babies their presence indicates improper digestion of fats, while in breast-fed babies they have no significance. It is more difficult to distinguish between fat curds and the normal fecal masses which are surrounded and separated by mucus and closely resemble curds. These two varieties may best be distinguished by the fact that the fat curds are white on the inside and often green on the outside, while the normal fecal masses are yellow in color all through. Normal fecal masses having the appearance of curds are of good import rather than bad. These masses will appear in the stools of an infant who has had a severe diarrhœa, within twenty-four hours after being put upon a boiled milk and water mixture. The mother or nurse should be warned that this will occur and that it is desirable, lest she fear that the milk is not being digested and possibly discontinue the feeding of her own accord. Each succeeding stool will show more of the fecal masses and less mucus until, on the third or fourth day, the mucus will have disappeared and the soft, homogeneous stool will be made up of one large fecal mass.

Mucus.—An appreciable amount of mucus is never seen in the normal stool. It can be recognized by its glistening appearance, although it is often simulated by undigested gruels appearing in the stool. An infant fed on pure barley gruel may have a watery, shiny stool which really contains

very little mucus, due to the gruel passing through the bowel undigested.

The presence of mucus indicates an inflammatory condition of the bowel or intestinal indigestion, so it is extremely important to recognize it. Other things being equal, the more mucus the more serious is the diarrhœa. Often the stool consists of bile-stained mucus only, especially when an infant is on a starvation diet and has been given a cathartic which has further irritated the bowels. It is not sufficiently recognized that underfeeding will give rise to these small, thin, and often numerous mucus stools. Generally all that is necessary to stop them is to give a food containing more milk, which increases the bulk of the fæces and at the same time supplies sufficient nourishment.

Mucus may be mixed through the stool so that the whole stool appears shiny and glistening, or it may be entirely separated from normal fecal masses, curds, or other undigested matter. If it is thoroughly mixed with the fæces it is an indication that the irritation comes from high up in the bowel, probably the small intestines, although there may be inflammation in the lower bowel also. Mucus which is separated from the curds or normal fecal matter comes from the lower bowel. This mucus is a wise provision of nature, furnished probably as a protection to the intestinal mucosa, and it therefore should not be removed by irrigations or cathartics.

Blood.—When blood is present in the stools in any appreciable quantity, provided it does not come from the rectum or anus, it is of serious import. When mixed with mucus and associated with frequent loose stools it is indicative of an infectious diarrhœa, usually dysentery or some organic lesion of the intestines.

A streak of blood on the outside of a hard stool, or pure, fresh blood associated with a normal stool, is indicative of a fissure, ulcer, polypus, or hemorrhoid in the anus or

rectum. Blood may also be due to organic and constitutional diseases, such as ulcer, intussusception, tuberculosis, scurvy, hæmophilia, or purpura.

Cathartics.—The discussion of cathartics will be taken up more thoroughly elsewhere, but it is well to remember that many mothers habitually give cathartics to their infants. This is true not only in constipation, but in diarrhœa. An infant having a diarrhœa should never receive repeated doses of cathartics. The whole cause of diarrhœa may be the cathartics which a mother is giving the infant each day and to which she has become so accustomed that it does not even occur to her to mention it. Careful inquiry should be made in every case to eliminate this possibility.

CHAPTER VIII

THE CLASSIFICATION AND DIAGNOSIS OF DIARRHŒAS IN BOTTLE-FED INFANTS

Diarrhœa is an abnormal condition of the bowels accompanied by frequent evacuations. The term is used to cover all conditions attended by frequent loose stools.

In a general way there have been two schools, one composed of those who consider that all diarrhœas are due to bacterial infection, and the other comprised of those who consider that all diarrhœas are chemical, due to the direct action of the sugar, salts, or fat upon the digestive apparatus and upon metabolism. It is evident that neither school is all in the wrong, nor is all in the right. The classification which is adopted in this book and which is given below is one which embraces both teachings.

Classification of Diarrhœas in Bottle-fed Infants

INTESTINAL INDIGESTION

(Dyspepsia Lowered Tolerance for Food)

1. Intestinal Indigestion from
   - (a) Fat.
   - (b) Sugar.
   - (c) Protein.
   - (d) Starch.
2. Intestinal Indigestion accompanied by
   - (a) Underfeeding.
   - (b) Overfeeding.
   - (c) Lowered Tolerance.

INFECTIOUS DIARRHŒA

1. Fermentative diarrhœa, (sugar or starch diarrhœa, sugar intoxication).
2. Putrefactive diarrhœa (protein diarrhœa).
3. Mild types of infectious diarrhœa.

4. Dysentery (acute infectious diarrhœa, ileocolitis, intoxication.
5. Parenteral infections.

MISCELLANEOUS

1. Marasmus (lost power of assimilation, decomposition, atrophy).
2. Coeliac disease.
3. Diarrhœa from cathartics.
4. Other organic causes (typhoid, amœbic dysentery, tuberculosis, ulcer, intussusception).

Diarrhœa may be divided into three classes: intestinal indigestion, infectious diarrhœa, and miscellaneous. Intestinal indigestion is the etiological factor in the largest class of diarrhœas. Infectious diarrhœas are most often seen in the summer or in warm weather. The two may overlap, since an infant with any form of indigestion is more susceptible to an infection and is consequently more liable to an infectious diarrhœa.

INTESTINAL INDIGESTION

Intestinal indigestion is caused by feeding mixtures containing more fat, sugar, protein, or starch than the individual infant is capable of digesting, or by feeding these elements in a form that cannot be digested by the infant. Most infants with diarrhœa due to intestinal indigestion have a combination of fat, sugar and protein indigestion which perhaps was originally due to one of these elements only. For instance, a diarrhœa which was originally caused by fat may have so lowered the digestive capacity of the intestines that the power to digest fat, sugar, protein, or starch is decreased. Often it is not possible to differentiate between fat, sugar, protein, or starch diarrhœa, nor is it always necessary from the very practical standpoint of treatment, for, by omitting the starch and artificial sugar altogether, boiling the milk to make the protein more digestible and cutting the fat down to the amount contained

in about one-third milk and two-thirds water (fat-free milk in the more severe type), the diarrhœa may be overcome.

Indigestion caused by fat is usually due to the use of top milk or cream. These feedings do not necessarily cause indigestion in all infants. They may be easily digested by infants having a good digestive capacity or by those whose digestive power has not been lowered or overtaxed by such mixtures. Fat indigestion is often so severe that an infant cannot take all the fat contained in whole milk (mixed milk), diluted three or four times, even though no artificial sugar is added to it, therefore it is often necessary to use skimmed milk mixtures.

Sugar Indigestion is caused by giving an excess of sugar. Some infants have a very low capacity for digesting sugar, often due to the error of giving too much of it at some time in the past. Occasionally too much sugar is given at the beginning of artificial feeding, or the sugar is later increased beyond the normal capacity of the infant. Sugar is frequently given too soon or increased too rapidly after an attack of diarrhœa. The increase in an infant's tolerance for sugar is very gradual, and consequently the sugar must be increased gradually.

Finkelstein and his co-workers, Meyer and Leopold, have proved conclusively that milk-sugar can, of itself, produce symptoms of intoxication. They have brought on fever and symptoms of sugar intoxication, by giving large amounts of sugar to infants who were particularly vulnerable to its toxic effect, producing the so-called "sugar fever." Leopold and Reuss have experimentally produced "sugar fever" in young infants. The symptoms are fever, diarrhœa, and sometimes vomiting, deep, slow respirations, stupor with a typical and characteristic facies,—that is, the eyes sunken and staring, the mouth open and twitching. Sugar may also be recovered in the urine.

Protein Indigestion may be eliminated by boiling the milk or by using lactic acid milk.

Gruels are undoubtedly a contributing factor in the cause of diarrhœa in certain infants when given in milk and sugar mixtures.

The word tolerance seems a very good term to use as an expression of an infant's ability to digest and assimilate food. Indigestion, whether from sugar, protein, or fat, lowers the infant's tolerance for any food. Feeding weak dilutions of milk without sugar gives the gastro-intestinal tract a chance to recuperate from the fat and sugar indigestion and thus raises the tolerance so that the milk can gradually be made stronger, increased in quantity, and later sugar is cautiously added. While these increases are being made in the food the tolerance is increasing. Practically all cases of simple indigestion due to fat, sugar, or starch are amenable to this treatment.

The Diagnosis of intestinal indigestion presents few difficulties. The onset is often gradual, the infant going from bad to worse on a feeding that it is unable to digest. There is no fever; in fact, a sub-normal temperature is not uncommon in infants who are underfed or who are poorly nourished. During this period the weight is stationary or there is a gradually progressive loss in weight. The cause may always be traced to a food which is unsuitable for the individual infant. The stools vary in number from two to ten or twelve in a day, and an examination of them may show many abnormalities. They may be either yellow, green, or brown in color. They may be watery or firm in consistency, but are never smooth and homogenous. A smooth stool may at times show curds and a certain amount of mucus, and is indicative of intestinal indigestion. The odor of the stool is either normal or sour-smelling. The reaction is not significant, for it may be either acid or alkaline, although it is more apt to be acid. Blood is never present in the stools of intestinal indigestion, unless it it due to some local condition found in the rectum or anus, such as a fissure or polypus. Curds usually are found in

the stools of infants suffering from intestinal indigestion when unboiled milk had been given in the food.

Underfeeding includes all those cases that are fed such weak mixtures or so little food that they could not gain even if they did not have intestinal indigestion. Unfortunately, many of these infants have a more or less severe grade of intestinal indigestion and diarrhœa, and their tolerance has been gradually reduced throughout the time the indigestion has lasted. Underfeeding is usually brought about in the following manner: An infant having a diarrhœa due to intestinal indigestion is wrongly treated by weakening the food,—that is, giving a mixture containing less fat, a little less sugar, and less protein. This does not stop the diarrhœa, so the food value is again reduced. The weaker food is still undigested, and the process of weakening is repeated until the infant is getting not nearly enough food to sustain it. In the same way an infant is wrongly given plain barley gruel to stop a fermentative diarrhœa. The stools, of course, do not improve, and the plain gruel is continued sometimes for two or three weeks, because it is reasoned that if the infant cannot digest so simple a food as gruel it would certainly not be able to digest milk. Diarrhœa is such cases is due to starvation. Malted milk and some of the proprietary foods which are given without milk often act in the same way, and, in addition, the diarrhœa may also be fermentative in type on account of the high carbohydrate content of the food. Milk and water boiled together without sugar will correct the disturbance.

Overfeeding is easier to treat, particularly if it occur in a well-nourished infant. When occurring in poorly-nourished infants, the ease with which the disease is remedied will depend upon the severity of the diarrhœa. It is a frequent occurrence to see infants that are being fed much more food than they need and which, if reckoned in calories, would be found to be many times the amount of food they actually require. There is the constant inclination to

increase the food beyond an infant's needs in the enthusiasm to make a big gain in weight. This may bring about diarrhœa, with stools showing various degrees of intestinal indigestion.

Lowered Tolerance that cannot be raised by the usual methods above the point where the infant will make a gain in weight, needs further explanation. Some infants have a very narrow limit between their digestive capacity and the amount of food they need to make a gain in weight. The indigestion can be overcome by stopping the sugar and giving boiled milk and water mixtures, but when the sugar is again added or the strength and quantity of the food is increased sufficiently to permit the infant to make a gain in weight a recurrence of the diarrhœa is brought about. This may be repeated many times and is due to the fact that the infant's tolerance has been permanently lowered for these mixtures. The condition is frequently not recognized until repeated unsuccessful efforts have been made to increase the food to a sufficient strength.

Intestinal indigestion also includes a type of diarrhœa formerly called mechanical diarrhœa. It was formerly thought that the curds and various other constituents of the food acted mechanically only through irritation of the bowel and thus caused the diarrhœa. Mechanical diarrhœa is now limited to cases occurring in infants and older children who have been given some specific indigestible article of food, such as uncooked starches, or the various other foods unfit for children. This form of diarrhœa has also been the cause of the absurd practice of treating all diarrhœas with a cathartic and a period of starvation. Such treatment is, of course, necessary in this type of diarrhœa.

INFECTIOUS DIARRHŒAS

Fermentative and Putrefactive Diarrhœa.—Although great advances have been made during recent years concerning the bacteriology of the intestinal tract, many questions still

remain unsettled. It is known, however, that the intestines normally contain both putrefactive and fermentative bacteria, as well as many other varieties. Under the proper conditions it is possible for the fermentative bacteria to be in the ascendency over the putrefactive bacteria, and the reverse is also true. These proper conditions are brought about by supplying the food upon which the bacteria will thrive. If a carbohydrate diet be given, the putrefactive bacteria, theoretically, will be starved out. If a protein diet be supplied the fermentative bacteria, theoretically, will be starved out. These theories form a basis for treatment which from a practical standpoint is very satisfactory in its results.

The fermentative type of diarrhœa is caused and aggravated by bacteria which thrive upon carbohydrates,— that is, starch or sugar. The Finkelstein school attributes this form of diarrhœas to carbohydrate indigestion: Kendall has shown the bacteriological cause. Undoubtedly many of those cases of diarrhœa are due to sugar indigestion, and many others to the growth in the intestinal canal of bacteria which live on carbohydrates. This is an academic question, however, which it is unnecessary to discuss, since both causes require the same treatment—that of stopping the carbohydrates and giving milk and water boiled together, or some other protein food. The fermentative type of diarrhœa is more common than the putrefactive type, because of the universal habit of giving a large amount of sugar to bottle-fed infants and also for the reason that, as has been asserted by various investigators, fermentative bacteria take precedence over putrefactive bacteria, or, as Kendall expresses it, "carbohydrate shields and spares protein from bacterial attack." A bacteriological examination of the stools is not practicable for the clinician and, as a rule, will not be found necessary.

Putrefactive diarrhœa is caused by bacteria which thrive upon protein. In certain cases the conditions for the growth

of putrefactive bacteria become sufficiently favorable to result in a change from a fermentative to a putrefactive diarrhœa. When this occurs it is necessary to give a carbohydrate diet in order to "starve out" the putrefactive bacteria.

The problem of distinguishing between the fermentative and putrefactive types of diarrhœa is often difficult. Apart from the stools, there are only two main points of distinction. The fermentative diarrhœa usually occurs in infants who have been fed a high sugar or starch diet, whereas the putrefactive diarrhœa occurs in infants who have been given strong milk mixtures with little or no sugar or starch in them, or in older infants who have been fed on a mixed diet. The therapeutic test is the second means of distinguishing between the two. If there is any doubt as to whether the diarrhœa is fermentative or putrefactive in type, the case should be treated first as a fermentative diarrhœa—for instance, with a one-third milk and two-thirds water mixture. If it is a fermentative diarrhœa it will respond readily to this treatment, but if it a putrefactive diarrhœa the treatment will be of no avail, and a carbohydrate diet will have to be used before the diarrhœa is overcome.

The reaction of the stools in fermentative diarrhœa is acid, usually giving rise to inflamed buttocks and chafing. The reaction of the stools of putrefactive diarrhœa is alkaline, and is not apt to be irritating to the skin. In determining the reaction of the stool it is necessary to get a stool that has been freshly passed and which is uncontaminated by urine. In order to do this, it is advisable to insert a small test-tube (with a hole blown in the side) into the rectum, taking out the fresh feces in this way for examination. The sour odor of the stools accompanying fermentative diarrhœa is very characteristic, and the foul odor of putrefactive diarrhœa (which resembles the odor of decayed meat) is also very helpful in differential diagnosis.

Mild Types of Infectious Diarrhœa are more common than severe cases, and are usually caused by bad milk or some contaminated food. They are characterized by their sudden onset and fever, attended usually with vomiting and intestinal pain, though one or both of these symptoms may be lacking. The stools may be foul, sour, or odorless, and are more usually acid than alkaline. They are generally green and watery,— sometimes frothy, due to gas, and contain mucus, curds, and undigested food. The severity of the attack depends upon the virulence of the infection, the previous health of the infant, and the promptness with which the cause can be located and removed and the proper treatment instituted.

Dysentery (synonymous with ileocolitis, infectious diarrhœa). Up to the present time several different microorganisms have been isolated from the stools of infants having dysentery, among which are the Flexner dysentery bacillus, the Shiga dysentery bacillus, the colon bacillus, and the streptococcus. According to Kendall, these bacteria no longer produce toxins when the diet is exclusively carbohydrate. This explains why the purely carbohydrate diet has been successful in combating certain cases of dysentery.

These are the cases that have been variously called ileocolitis, dysentery, cholera infantum, and possibly some of the cases classified by Finkelstein as intoxication. There is a history of a sudden onset, high temperature, prostration, vomiting and extremely numerous loose stools, containing mucus and blood.

The diagnosis of dysentery presents few difficulties. An infant who has previously been well, or one who has had intestinal indigestion, is suddenly attacked by a severe illness. The temperature ranges from 104° to 106°, there is uncontrollable vomiting at the onset and rapid loss of weight. The stools are numerous, ten or twenty—or even more—in twenty-four hours, and, after the fecal matter which was in the bowels at the onset has been evacuated,

are composed almost entirely of blood and mucus, each evacuation being accompanied by tenesmus.

Another type of dysentery which was formerly called cholera infantum, occurs in young infants. Although there is no blood in the stools the infecting organism is malignant indeed. It is characterized by a sudden onset, high rise in temperature, almost continuous vomiting, profuse diarrhœa, stools which quickly lose their fecal character and are white in color, like rice water, and consist almost entirely of serum and mucus. The fluids of the body are rapidly drained, collapse follows, often with coma, and death within from twelve to thirty-six hours of the onset.

Parenteral Infections.—Diarrhœa coming on during the course of any infectious disease is called a parenteral infection. Since our attention has been called to this form of secondary diarrhœa it is surprising to see how many diarrhœas in infancy and early childhood arise in this way. The common cold is the greatest offender because common colds are always among us, and few infants escape. An infant that is progressing nicely on his formula, gaining in weight and having normal stools suddenly starts with diarrhœa, and simultaneously, or even a day or two later, coryza, cough and perhaps fever appear. It is then obvious that the diarrhœa was caused directly or indirectly by the same micro-organism that caused the cold. Pneumonia, bronchitis, otitis media, mastoiditis, tonsilitis and other throat infections, ethmoiditis, sinusitis, diphtheria, the acute exanthemata, pyelitis and in fact any of the infectious diseases may be the primary cause of diarrhœa. Not only is this true of acute diarrhœa arising during an acute infection, but chronic diarrhœa and malnutrition may be caused by chronic or sub-acute infections such as bronchitis, toncillar and chronic ear infections. It has recently been shown that unrecognized mastoiditis are responsible for malnutrition and chronic and recurrent gastro-intestinal

disturbances even though there is no discharge from the ears, and that mastoid operation clears up the diarrhœa and immediate improvement in the nutritional condition follows. The treatment consists therefore in treating the local condition in conjunction with the diatetic treatment.

MISCELLANEOUS DIARRHŒAS

Marasmus (lost power of assimilation, wasting disease, decomposition, athrepsia, atrophy). This condition is so well known that it hardly needs explanation. According to Grulee, it is a "chronic state of malnutrition seen in infants, characterized by inability to so assimilate the food given, as to gain weight properly, by sub-normal temperature, emaciation, and by greatly lowered resistance." The name "decomposition" has been given by Finkelstein to this well-known condition, but it only serves to confuse the nomenclature.

Any infant with diarrhœa absorbs less food than under normal conditions and since diarrhœa calls for a reduction in the amount of food a loss of weight results. The stored fat and glycogen are first used up and then the body protein is drawn upon for fuel, resulting in destruction of the body tissues or starvation. Therefore, prolonged diarrhœa improperly treated plus starvation is the cause of marasmus, although the primary cause is often a chronic or sub-acute infection (parenteral infection) such as chronic bronchitis, broncho-pneumonia, pyelitis, otitis, unrecognized mastoiditis, tuberculosis and syphilis or congential heart disease, atelectasis and prematurity.

Every organ in the body suffers during this process of destruction because the blood volume diminishes and the heart mechanism is disturbed and therefore the intestitinal tract and the digestive glands are incapable of proper digestion and absorption.

The clinical picture is striking, the wizened ape-like face, the slate gray pallor, thin wrinkled skin, the emaciated

body with ribs and bony frame outlined, depressed fontanelle, the eyes sunken back in their sockets, the hands like bird's claws, give a pathetic appearance. The cry is feeble, the extremities cold, the heart sounds are weak and the temperature sub-normal. There is a lowered resistance to infection. The stools are usually loose but there may be intervals when normal stools are seen. Edema may increase the weight unexpectedly but collapse is apt to follow, although it is astonishing how long such an infant may live on, neither gaining nor losing in weight. When we consider that most of these cases begin with diarrhœa which has been improperly treated and starvation which is unnecessary for the cure of the diarrhœa, it is regrettable indeed.

Coeliac Disease.—This is a chronic form of diarrhœa with acute exacerbations, with an unknown etiology usually beginning during the second year of life, rarely seen through the first year, but not uncommon between the second and fifth year. There are four outstanding features that lead to the diagnosis: first, a characteristic diarrhœa, second, vomiting, third, abdominal distention, and fourth, progressive and extreme emaciation, muscular weakness and anæmia.

The characteristic stools are large, foul, bulky and greasy from undigested fat. There may be only two or three a day for a time. Intermittently, usually at intervals of several weeks or even months, acute diarrhœa intervenes with ten or fifteen or more loose, watery, greenish, yellow, frothy, mucus stools, lasting for a few days or longer, if not controlled dietetically. The large amount of fat in the stools points toward a decrease in the bile or some disturbance of the biliary secretion. The liver itself may be small. Although the pathology is not known, it is a well established fact that all fats must be eliminated from the diet.

The vomiting is also characteristic in that it does not occur regularly. There may be intervals of months or weeks when no vomiting occurs. When it does occur, it is

usually only two or three times a day. It may keep up for a week or two, especially when improperly treated. The vomiting is caused by the low acidity of the stomach. In almost every case there are intervals when free hydrochloric acid is absent, and a total anacidity occasionally occurs. This points the way to the treatment which is acidified milk or lactic acid milk.

The abdominal distention is caused by dilation of the colon. When accompanied by emaciation, the tremendously large abdomen gives a very striking picture quite different from a marasmic child. Usually coeliac children have formerly been well nourished, or perhaps even fat, so that the skin does not tightly cover the bones but hangs in folds over the atrophied muscles and loosely covered bones. The muscular weakness is often so extreme that the arms or legs cannot be voluntarily lifted from the bed, the child lies on its back, barely able to turn the head from side to to side. For some unexplained reason the fat-pads do not disappear from the cheeks as they do in marasmus, nor are the eyes sunken, so that the facial appearance and expression, while characteristic, is not as distressing to look upon. It is disconcerting to see a child of one to two years, with long hair, all its teeth, often talking or saying a few words, but weighing only ten or twelve pounds, and having to be fed and carried about and treated like an infant of a few months.

The course of the disease depends upon the treatment, but it is slow at its best, since there is an intolerance for both fats and sugars and starches.

Other Organic Causes.—Typhoid fever, amœbic dysentery, tuberculosis, ulcer, and intussusception are noted here only to make the classification complete. A discussion of them would be out of place in this book.

Diarrhœa from Cathartics.—Diarrhœa is frequently caused by the continued and daily use of cathartics, and it is very important to recognize this form in order to correct it.

CHAPTER IX

TREATMENT OF DIARRHŒAS IN BOTTLE-FED INFANTS

Diarrhœa in bottle-fed infants is as often the result of intestinal indigestion or non-digestion, due to incorrect feeding, as it is to bacterial infection.

By "incorrect feeding" is meant a food which is not suitable for the individual infant at a particular time, and not necessarily a food that is improper under other circumstances.

Formerly all cases of diarrhœa were treated in a routine manner with a cathartic, followed by a period of starvation, because all were thought to be due to a bacterial invasion from sources outside the body, and it was believed that the undigested food within the bowel should be removed by this means. Since only a portion of the cases of diarrhœa is due to an infection, and since the bowel usually is emptied very thoroughly of its own accord without the assistance of cathartics, it is not advisable to use them in every case of diarrhœa. In selected cases a cathartic followed by a period of starvation is a very useful procedure, but both cathartics and starvation have done a great deal of harm.

It would seem most illogical to treat all cases of diarrhœa in the same routine manner, and the author's experience has shown that the results of such routine treatment are not successful. In older, stronger infants cathartics aggravate the diarrhœa when the bowel is already irritated by intestinal indigestion, and with small, emaciated infants, who have no strength to lose from starvation, it is still more harmful to starve them and to further irritate the bowels with cathartics. This treatment is often the means of reduc-

ing an infant to such a condition, that recovery from the loss of strength which it has cost is an impossibility.

The author recalls a case, seen some years ago, which was typical of the results obtained with the older plan of treatment.

It was a weak, pale, emaciated infant of two or three months of age who had never done well upon its feedings and who had had frequent loose, curdy, mucous stools from intestinal indigestion for the greater part of its life. At that time every infant with diarrhœa was first "cleaned out" with a dose of castor oil, and was then given albumin water for twenty-four hours. This baby received the routine treatment, and, as might have been expected, lost five or six ounces in weight as a result without much improvement in the condition of the stools. Milk feedings were then instituted, and at the end of the week the stools were as bad as ever. A cathartic and a day of starvation was again used, resulting in further loss of weight and strength. This process was repeated three or four times, with a loss of weight each time, until the mother took it into her own hands, stopped further cathartics, and fed the baby very successfully herself.

In the light of our present knowledge, such diarrhœas could now be controlled inside of three or four days by the proper dietetic measures and without the use of any cathartic whatever.

It is absolutely necessary to stop a diarrhœa, even if it is very mild in character, before giving an infant a food of the proper quality and quantity to make a gain in weight. While we are getting control of the bowels and until the digestion is straightened out an infant's actual caloric needs must be disregarded.

The treatment of diarrhœa in bottle-fed infants is almost entirely dietetic. Drugs are of minor importance, and,

even when they are employed, a proper feeding must still be instituted.

There are two different methods of treating diarrhœa, and each has its own indications.

PROTEIN FOODS

(a) One-third milk and two-thirds water, boiled together, no sugar.
(b) Protein milk or calcium caseinate mixtures.
(c) Lactic acid milk.

CARBOHYDRATE FOODS

(a) Barley gruel.
(b) Sugar solutions.
(c) Thick gruels of various kinds, such as cornstarch, arrowroot, farina etc., fed with a spoon. Breadstuffs.

CHAPTER X

PROTEIN FOODS IN THE TREATMENT OF DIARRHŒA

Protein Foods

(a) One-third milk and two-thirds water, boiled together, no sugar.
(b) Protein milk or calcium caseinate mixtures.
(c) Lactic acid milk.

These varieties of protein foods are used in different types of cases and it requires considerable skill and experience to determine which will most quickly and surely stop the diarrhœa in the case at hand. First, it must be decided whether a protein or carbohydrate food is to be used and then which variety of these foods is best.

One Third Milk and Two Thirds Water, Boiled Together, no Sugar

Indications.—(1) Indigestion from fat, sugar, protein, or starch; (2) underfeeding; (3) overfeeding; (4) mild types of fermentative infectious diarrhœa of short duration.

It is only in mild types of diarrhœa of short duration, usually in infants under three months of age, that this mixture is indicated. If one is of the opinion that the diarrhœa can be cleared up in two or three days, and the strength of the food can then be increased and sugar added without causing a recurrence of the diarrhœa, one-third milk is the food of choice. One-third milk without sugar or without calcium caseinate always brings about a loss of weight if continued any length of time, except in very young or very small infants.

One-third whole milk and two-thirds water is advised as a routine mixture, as it gives an infant who has been underfed sufficient nourishment for a short period while the diarrhœa is being controlled. The infant who has been underfed will not lose as much weight as upon an exclusive gruel diet, and the infant who has been overfed or has considerable indigestion from wrong feeding will do well upon it, because it gives the stomach and intestines a rest without starvation measures.

Although one-third milk and two-thirds water may be used as a routine, very small infants under six pounds in weight who have a bad diarrhœa, and possibly those who have been fed on foods not containing milk, may be started with one-quarter milk and three-quarters water, which should be rapidly increased as the diarrhœa improves. On the other hand, older and larger infants who have formerly been fed strong milk mixtures and who are not suffering with a severe form of diarrhœa may have one-half milk and one-half water. Whole milk should be used, and, since top milks have been in favor so long, it is always wise to instruct a mother to mix the milk thoroughly by pouring it into a pitcher and back into the bottle.

Barley gruel as a diluent does not always act as well as plain water. Some infants do not digest gruels well, especially very small, weak infants. Since this is true, and since the addition of gruels does not make the proteins more digestible, it is best not to use them except for older infants.

Boil the Milk and Water Together.—Formerly it was believed that boiled milk was more difficult to digest than raw milk. This is not a fact, for it has been proved conclusively that boiled milk is more easily digested than raw milk (see page 309). If the milk has been properly boiled, tough, hard curds do not form in the stomach, nor are they seen in the stools. Formerly the author attempted, in many instances, to control diarrhœa with unboiled mixtures,

and most often failed. It should be distinctly understood that the milk is not boiled to kill bacteria, but to make the milk itself more digestible. It is advisable to use certified milk, with a low bacterial count, if it is procurable.

Boiled milk is more effective when the milk and water are boiled vigorously together. The following directions should be carefully carried out: Measure out the required number of ounces of water, put into a saucepan and bring it to an active boil. While the water is boiling, pour in the required number of ounces of milk and bring the mixture to the boiling-point as rapidly as possible, stirring all the time so that a scum will not form upon the top. This scum is undesirable, for the reason that it stops up the nipples if retained, and if discarded carries with it a certain amount of food value, as it is made up of fat and albuminous protein. Boil actively for three minutes after it has once come to a boil. Pour immediately into clean feeding bottles, using as many bottles as there are to be feedings in twenty-four hours. Cool them as quickly as possible in cold water in the summer time and out of the window in the winter time, and then place directly upon the ice until used.

It is best to continue giving the boiled milk after the diarrhœa has stopped. Some infants will always do better on the boiled milk and get up a diarrhœa as soon as the boiling is discontinued. It will be sometimes argued that an infant fed on boiled milk over a prolonged period will develop scurvy. This danger can be obviated by the simple expedient of giving orange juice between feedings after it has been found necessary to give boiled milk longer than two months.

Stop All Sugar.—Sugar is undoubtedly the most laxative constituent of the bottle-fed infant's food. It is also the element of the food that most frequently causes indigestion. Those who have treated many cases of diarrhœa by omitting artificial sugar from the food can have no doubt of this fact. Although sugar does not always act as a laxative when given

to infants who are constipated (except in cases where the sugar is already deficient), it is a laxative where there is a tendency toward diarrhœa. It is well, therefore, not to give any sugar at all until the stools have become normal and have remained normal for at least three days.

The mistake is often made of reducing the sugar in quantity instead of stopping it altogether. An exception to this rule must be made when an infant has been so weakened by wrong feeding or lack of sugar that it is in a state of collapse, in which case the lack of sugar would be dangerous.

It must be ascertained whether or not the mother gives sugar and water between feedings, which habit should be prohibited. The objection is usually offered that the infant will not take any feeding without sugar, because it is accustomed to the sweetened food. It is advisable to explain that the infant will take its food when sufficient appetite has been acquired, and that it is not necessary to give water between feedings except to stop excessive crying. *Saccharine may be added to the water or to the food.*

Avoid Cathartics.—Abt has shown that calomel administered to normal, healthy babies with no digestive disturbances will cause blood to appear, microscopically at least, in the stools. In a series of twenty cases he found this to universally true. It can readily be seen then how much more harm calomel will do when the bowels are already irritated, as during a diarrhœa. Castor oil, although not so violent in its action as calomel, is also injurious in its effects in certain cases. Clinically it has been demonstrated that the various forms of diarrhœa mentioned in this chapter can be controlled more easily without the use of a cathartic.

(1) **Intestinal Indigestion from Fat, Sugar, Protein, and Starch.**—This method is particularly useful in treating undersized, young infants who have never done well on any food and who have had intestinal indigestion, as indicated by the presence of curds and mucus in their stools.

Case XVIII

(Illustrating the use of one-third boiled milk in a case of intestinal indigestion)

April 24: Age, 3 months. Weight, 10 lb. 13 oz.

General Condition.—Fairly well nourished, active, cries night and day; needs from 50 to 55 calories per pound per day.

Stools.—For two weeks, *eight or ten a day, yellow, watery, with many curds* and *much mucus,* no blood.

Vomiting.—None.

Appetite.—Ravenous.

Sleep.—Very little.

Temperature, 98.6° F.

Chief Complaint.—Diarrhœa.

Previous Food:

Top milk (7 per cent. fat) ..	8 oz.	Fed 4 oz. every 3 hours, 7 feedings in 24 hours.
Water......................	19 oz.	
Lime water.................	1 oz.	
Milk sugar.................	5 teaspoonfuls.	

Treatment.—Food prescribed:

Whole milk.........	12 oz.	boiled	Divide into 7 bottles. Feed 5+ oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M. and 2 A.M.
Water..............	24 oz.	boiled	
Sugar..............	0 oz.		

April 29 (5 days later): Weight, 10 lb. 12 oz.
Loss, 1 oz.

General Condition.—The same.

Stools.—*Two yellow, smooth, hard, no mucus, no curds.*

Vomiting.—None.

Appetite.—Ravenous.

Sleep.—Poor.

Treatment.—Food prescribed: Increase milk (in previous formula) one ounce each day, decreasing the water one ounce each day until the formula is:

Milk	18 oz.	boiled	Divide into 7 feedings. Feed 5+ oz. every 3 hours as before.
Water..............	18 oz.	boiled	
Dextri-maltose	¼ oz.		

This infant had always been fairly well fed according to the old standard of top milk. The milk-sugar or the fats had evidently caused a diarrhœa. In three days the stools became normal with the boiled milk and water mixtures without sugar. Subsequently the sugar was increased a quarter of an ounce at a time up to 1½ ounces without any recurrence of the diarrhœa.

(2) **Underfeeding.**—One-third boiled milk is also very useful in diarrhœa of infants who have been fed over a prolonged period of time upon barley gruel without milk, upon malted milk, or any of the foods which are given without milk. It is a frequent occurrence to see an infant with diarrhœa that has been fed exclusively upon barley gruel for two or three weeks. The gruel has been wrongly continued in the belief that if the infant could not digest so simple a food as gruel it certainly could not digest milk.

CASE XIX

(Illustrating the use of one-third milk in a case of underfeeding)

May 23: Age, 5 months. Weight, 13 lb.

General Condition.—Fairly well nourished, color fair, languid.

Stools.—For two weeks, *eight or ten a day, small, brown, watery, mucus,* no curds.

Vomiting.—None.

Appetite.—Poor.

Sleep.—Fair.

Temperature, 98° F.

Chief Complaint.—Diarrhœa.

Previous Food.—This infant was breast-fed until one month ago, when the mother died. Various modifications of top-milk mixtures were given until two weeks ago, when diarrhœa commenced, for which reason the baby was put upon barley gruel. It had lost one pound in weight during this period.

Treatment.—Food prescribed:

Milk	12 oz.	boiled	Divide into 7 bottles. Feed 5+ oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M. and 2 A.M.
Water..............	24 oz.		
Sugar	0		

Increase the milk and decrease the water one ounce each day until the next visit.

May 28 (5 days later): Weight, 13 lb.

General Condition.—The same.

Stools.—For last two days, *two yellow, smooth, soft, homogeneous, no curds.*

Vomiting.—None.

Appetite.—Good, takes all the food.

Sleep.—Same as before.

Treatment.—Food given:

Milk	20 oz.	Divide into 7 bottles. Feed 5+ oz. every 3 hours as before.
Water....................	20 oz.	
Cane sugar	$\frac{1}{4}$ oz.	

This infant continued to have normal stools and made a continuous gain in weight with a gradual increase of the milk and sugar. The method of increasing the milk one ounce each day and decreasing the water one ounce each day may be occasionally used when it is not practicable to see the infant every day, and when it is badly in need of nourishment.

It is not uncommon to see an infant who, because it has not seemed to digest the food in the proper strength, has been given a food which is a little more dilute. The stools still show that there is intestinal indigestion, because the tolerance has not been increased by eliminating the element of the food which is causing the disturbance, and the food is diluted again. This process of weakening the food is repeated again and again until its nutritional value is far below the infant's needs, and the diarrhœa still keeps up, the tolerance at the same time being gradually lowered.

Case XX

(Illustrating the use of one-third boiled milk in a case of indigestion underfeeding, and lowered tolerance)

December 31: Age, 4 weeks. Birth weight, 5 lb.
Present weight, 4 lb. 5 oz.
Loss since birth, 11 oz.

General Condition.—Emaciated, pale, languid, feeble cry; needs 65 calories per pound per day.

Stools.—Since birth, *five or six green, mucous, watery stools, with curds.*

Vomiting.—None.

Appetite.—Leaves one ounce four or five times a day.

Sleep.—Good most of the time.

Temperature, 97° F.

Chief Complaint.—Not gaining in weight; diarrhœa.

Previous Food.—High fat mixtures gradually weakened to

Top 2 oz. of two quart bottles of milk.	4 oz.	
Lime water	4 oz.	Fed 2½ oz. every 2½ hours, 8 feedings in 24 hours.
Water	12 oz.	
Sugar	0	

Treatment.—Food prescribed:

Milk	10 oz.	boiled	Divide into 10 bottles. Feed 3 oz. every 2 hours, 10 feedings in 24 hours.
Water	20 oz.	boiled	
Sugar	0		

January 3 (3 days later): Weight, 4 lb. 5 oz.
No gain or loss.

General Condition.—The same.
Stools.—*Three yellow, smooth, soft, homogeneous, no mucus or curds.*
Vomiting.—None.
Appetite.—Good, takes all the food.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	10 oz. (200 cals.)	boiled	Divide into 10 feedings. Feed 3 oz. every 2 hours, 10 feedings in 24 hours.
Water	20 oz.		
Dextri-maltose	¼ oz. (30 cals.)		

(230 calories, or approximately 55 calories per pound.)

January 7 (4 days later): Weight, 4 lb. 8 oz.
Gain, 3 oz.

General Condition.—The same.
Stools.—The same.
Vomiting.—The same.
Appetite.—The same.
Sleep.—The same.

This infant gained almost continuously and doubled its weight after 3½ months, with, of course, a gradual increase in the strength of the food.

This case is illustrative of how a very weak infant, underfed all its life with top milks, may be relieved of its intestinal indigestion in three days. It will be noticed that this infant had lost 11 ounces since birth and was too weak to cry lustily. In this case, fortunately, there was no vomiting.

(3) Overfeeding.—One-third boiled milk may also be used successfully in some cases in treating older infants who are not emaciated but who have been overfed, using half milk and half water for infants who are already accustomed to strong milk mixtures. It is optional, however, with these cases, whether boiled milk and water or barley gruel is used temporarily to rest the digestive apparatus.

Case XXI

(Illustrating the use of one-third boiled milk in a case of overfeeding)

June 6: Age, 6 months. Weight, 18 lb. 14 oz.

General Condition.—Fat, pale, slightly rhachitic; needs from 40 to 45 calories per pound per day.
Stools.—For two weeks, six or eight green, watery, with much mucus and soft curds.
Vomiting.—None.
Appetite.—Poor, leaves half of the food.
Sleep.—Poor, cries a good deal.
Temperature, 98.6° F.
Chief Complaint.—Diarrhœa.

Previous Food:

Undiluted unboiled milk with 1 grain citrate of soda to the ounce. This had been the food since birth, given in increased quantities.	Fed 8 oz. every 3 hours, 6 feedings in 24 hours.

Three days ago changed to:

Milk	32 oz.	Fed 8 oz. every 3 hours, 6 feedings in 24 hours.
Barley gruel	16 oz.	
Cane sugar	1 oz.	

Treatment.—Food prescribed:

Milk	21 oz.	boiled	Divide into 5 bottles. Feed 8 oz. every 4 hours.
Water	21 oz.		

June 9 (3 days later): Weight, 18 lb. 12 oz.
Loss, 2 oz.

General Condition.—The same.
Stools.—Three yellow, smooth, soft, homogeneous, no mucus, no curds.
Vomiting.—None.
Appetite.—Good, takes all the food.
Sleep.—Better.

Treatment.—Food prescribed:

Milk	28 oz.	boiled	Feed 8 oz. every 4 hours, 5 feedings in 24 hours.
Water	14 oz.		
Sugar	0		

June 12 (3 days later): Weight, 18 lb. 12 oz.
No gain or loss.

General Condition.—The same.
Stools.—One yellow, hard (constipated), homogeneous.
Vomiting.—None.
Appetite.—Good, takes all the food.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	30 oz.	boiled	Divide into 5 feedings. Feed 8 oz. every 4 hours as before.
Water	12 oz.		
Cane Sugar	½ oz.		

The digestion remained normal and an increase in weight followed as soon as enough sugar could be added to supply the infant's caloric needs.

(4) **Mild Types of Fermentative Diarrhœa.**—The treatment for this form of diarrhœa is the same in all respects as that employed in cases of simple sugar and fat indigestion.

Case XXII

(Illustrating the use of boiled milk mixtures for fermentative diarrhœa)

July 28: Age, 3 months 1 week. Weight, 10 lb. 12 oz.

General Condition.—Fairly well nourished, pale, skin elastic, musculature poor (flabby). Needs from 50 to 55 calories per pound per day.

Stools.—For one week, five or six green, foamy, watery, sour-smelling, some mucus, no curds.

Vomiting.—Three or four times a day.

Appetite.—Hungry.

Sleep.—Poor.

Temperature, 101° F.

Chief Complaint.—Diarrhœa.

Previous Food:

Eagle Brand condensed milk	1 teaspoonful	Fed 8 oz. every 2 hours, 12 feedings in 24 hours (making about 80 oz. of food a day).
Water	20 teaspoonfuls	

Treatment.—Food prescribed:

Milk	15 oz.	boiled	Divide into 7 bottles. Feed 5½ ounces every 3 hours.
Water	25 oz.	boiled	
Sugar	0		

August 1 (4 days later): Weight 10 lb. 10 oz.
Loss, 2 oz.

General Condition.—As at last date.

Stools.—Three yellow, smooth, no mucus, no curds.

Vomiting.—None.

Appetite.—Hungry.

Sleep.—Good.

Temperature, 98° F.

Treatment.—Food prescribed:

Milk	18 oz.	boiled	Divide into 7 feedings. Feed as before.
Water	22 oz.	boiled	
Sugar	0		

August 3 (2 days later): Weight, 10 lb. 12 oz.
Gain, 2 oz.

General Condition.—As at last date.
Stools.—One normal.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Fair.

Treatment.—Food prescribed:

Milk	20 oz.	Divide into 7 feedings. Feed as before.
Water	20 oz.	
Dextri-maltose	¼ oz.	

This infant continued to have normal stools throughout the summer, and, after the sugar and milk could be increased in quantity, gained progressively in weight.

Protein Milk and Calcium Caseinate Mixtures

Indications.—(1) Intestinal indigestion and fermentative diarrhœa, severe or of long standing; (2) any case of diarrhœa in which carbohydrate foods fail after a thorough and persistent trial; (3) dysentery and severe infectious diarrhœas which are not improved or benefited by carbohydrate foods; (4) selected cases of marasmus.

Protein milk after Finkelstein's formula is a food made by adding the curds of one quart of milk (the whey having been separated and discarded) to one pint of water and one pint of buttermilk.

Finkelstein's original idea was to make a food containing as little sugar and salts as possible, believing that under certain conditions the lactose and the salts contained in the milk itself were the harmful ingredients of cow's milk. By coagulating the milk, the curds, containing the casein protein and fat, are retained and the whey, which is made up of the albuminous protein, sugar, salts and water, is discarded, all but a small portion of the sugar and salts being soluble in the whey. Buttermilk also has a low sugar content because part of the sugar has been destroyed during the process of fermentation. When this mixture is completed

we have a food with about 1 per cent. of sugar, a very high protein content (chiefly casein protein), and a little less fat than is found in undiluted cow's milk.

Protein milk is useful in severe cases of intestinal indigestion where the tolerance for sugar has been lowered to such an extent that even the small amount of sugar contained in diluted cow's milk causes trouble. There are also theoretical grounds for using the feeding as in cases of severe fermentative diarrhœa, where the fermentative bacteria are kept alive by even a small amount of sugar, and particularly where the diarrhœa is of long duration. Certain cases of marasmus do well upon this food, due to their liability both to sugar indigestion and to fermentative diarrhœa.

Like other complicated feedings, many elements determine its usefulness, and there are probably other elements besides the mere absence of sugar and salts that enter into the successful use of protein milk. The fact that the curds have been coagulated and mechanically separated again undoubtedly has something to do with the efficacy of the food. The buttermilk, containing as it does lactic acid bacilli, may have its influence on the intestinal flora, and, finally, the high food value of such a mixture is very desirable.

Protein milk is made in the following manner: one quart of whole milk is warmed to blood heat (100° F.). One teaspoonful of liquid rennet, or essence of pepsin, or a junket tablet dissolved in a little cold water, is thoroughly stirred into the warm milk. It is then allowed to stand quiety until it is thoroughly jellied, which generally takes from ten to twenty minutes. It is then put upon the stove and is heated to a steaming heat (160° F.), being stirred vigorously all the time. This process is to kill the pepsin or rennet so that it will not curdle the buttermilk when added to it later. The curds and whey now being separated are poured into a fine wire colander or sieve and all the whey is allowed to drain off. The whey is then discarded and the curds pressed

through the wire sieve with a wooden spoon. These curds are very tough from the heating, and it requires considerable time and muscular effort to push them through the sieve. During this process of breaking up the curds cold water may be poured upon them (to aid in the process) from the pint which has already been measured out for this purpose. When the curds have all been pushed through and scraped off the bottom of the sieve the balance of the pint of water is added and the mixture strained through the sieve at least two more times. To this pint of curds and water is finally added one pint of buttermilk, and the food is completed. Buttermilk from the churn is the best, but artificial buttermilk may be used when made of skimmed milk, soured with the lactic acid bacillus. It may be sweetened with saccharine, one grain to the quart of food, if on account of the taste it is not well taken.

The quantity to be given and the intervals between feedings depend upon the age, size, and weight of the infant. With the exception of the "paradoxical weight reaction" to be described later, the more food given (within the proper limits) the sooner is the diarrhœa improved. In the author's opinion, it is seldom necessary to give protein milk after the diarrhœa has been permanently checked, for that is the chief purpose of the food. It is well, however, to continue it two or three days after the stools have become solid, in order to prevent a recurrence. Finkelstein and others in this country have added sugar to protein milk and continued its use indefinitely, but there seems to be no necessity for this, since, once the diarrhœa is checked, other foods may be substituted. It is seldom advisable to continue the food longer than ten days unless sugar is added, and with small, young infants who are emaciated and have little power of resistance it should not be given for even so long a time. Often within forty-eight hours the desired results may be obtained: the stools become dry or pasty, the mucus disappears, and by continuing the

protein milk for two days longer a recurrence is prevented.

When protein milk is stopped, boiled milk and water without sugar should be given. It is never best to change abruptly from protein milk to a food which has artificial sugar added to it, as the amount of lactose already in the milk is sufficient at the beginning. Sugar may be gradually added later, as is done after any diarrhœa.

After a little experience, one learns to recognize at once these severe grades of diarrhœa in which protein milk is the food of choice rather than the boiled milk mixtures. The poorly-nourished infant whose feedings have been fairly rational or in whom the boiled milk feedings have been used unsuccessfully, or the infant whose stools show a large amount of mucus thoroughly mixed with the fecal matter, should receive protein milk at once. Where these conditions are not present the boiled milk mixtures are usually effective, especially in the seasons when diarrhœas are less resistant to treatment. During the hot summer months when the diarrhœas are severe and difficult to correct and infants are much more prostrated, protein milk is practically indispensable. In the author's hands, it has been more prompt in its action and saved more lives than any other one food. The protein milk is difficult to make, and for that reason is not advised in cases where it is possible to clear up the diarrhœa with simple boiled milk and water mixtures.

Case XXIII

(Illustrating the use of protein milk in severe intestinal indigestion)

April 10: Age, 4 months. Birth weight, 6 lb.
Present weight, 8 lb.
Gain since birth, 2 lb.

General Condition.—Emaciated, weak, poor musculature; pale, gastro-intestinal facies; needs from 60 to 65 calories per pound per day.

Stools.—For ten days, eight or ten green, watery stools, containing much mucus and many curds each day.

Vomiting.—Some after each feeding.

Appetite.—Ravenous.

Sleep.—Poor; cries most of the time.

Temperature, 98° F.

Chief Complaint.—Diarrhœa.

Previous Food.—During the first week of life an effort at breast feeding was attempted and failed. Top milk mixtures with lactose were used for the first two and a half months with constant indigestion, diarrhœa, vomiting, and no gain in weight. She was then in such bad condition that a wet nurse was necessary, and with this breast milk she gained two pounds in weight, with a cessation of her digestive disturbances. She then weighed eight pounds and the wet nurse was discontinued because of the loss of her milk. Cream and whey and sugar mixtures were used for two weeks, the last ten days of which time the stools were as above.

Treatment.—Protein milk was given. 4 oz. every 3 hours, 7 feedings in 24 hours, at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.

April 13 (3 days later): Weight, 7 lb. 14 oz.
Loss, 2 oz.

General Condition.—Same as before, except that facial expression has improved.

Stools.—Three large, pale green, firm, smooth, homogeneous, with no mucus.

Vomiting.—None.

Appetite.—Ravenous.

Sleep.—Better.

Temperature, 98° F.

Treatment.—Protein milk continued. Same quantity and intervals.

April 16 (3 days later): Weight, 8 lb.
Gain, 2 oz.

General Condition.—As at last date.

Stools.—One large, hard, dry, crumbly, pale green, no mucus.

Vomiting.—None.

Appetite.—Ravenous.

Sleep.—Poor.

Treatment.—Food prescribed:

Milk	12 oz.	boiled	Divide into 7 feedings. Feed 5 oz. every 3 hours.
Water	24 oz.		
Sugar	0		

Increase the milk one ounce and decrease the water the same amount each day until the formula is half milk and half water.

This infant had no return of the diarrhœa as the strength of the milk was increased and sugar added, and at one year of age weighed twenty pounds.

The sugar indigestion was so severe and the infant was so sick that it was considered best to begin at once with the protein milk instead of the plain milk and water. The

bowels were normal by the third day. It is generally best to wait until they have been normal for three or four days or until they are constipated, as they were in this case, before changing to boiled mixtures. Protein milk is now obtainable dried and marketed in cans in powder form. Such a preparation is manufactured under the name of protein milk by Mead Johnson and Merrill Soule. Although it may be a question whether this convenient and easily prepared protein milk is always as effective as the freshly prepared product, it is much safer in unskilled hands and is not so disagreeable in its taste and is vastly less difficult to make. The only preparation needed is to dissolve the food in water.

Case XXIV

(Illustrating the use of protein milk in diarrhœa which has been unrelieved by other methods)

August 17: Age, 10 months. Weight, 16 lb. 8 oz.

General Condition.—Fairly well nourished, tall stature, otherwise well developed. Skin shows some wrinkling due to recent loss of weight.

Stools.—For the last two weeks has had six to ten stools a day, green or yellow, watery, normal odor, with a great deal of mucus and no curds.

Vomiting.—None since onset.

Appetite.—Poor.

Sleep.—Extremely restless.

Temperature.—Some fever at onset, now 98° F.

Chief Complaint.—Diarrhœa.

Previous Food.—Had been bottle-fed with the proper milk mixtures until the onset of the diarrhœa two weeks ago. At that time barley gruel had been given for two days, after a dose of castor oil. Boiled milk and water mixtures were then substituted. A week ago another dose of castor oil had been given, followed by albumin-water feedings for two days. Again half milk and half water were given, boiled together, eight ounces every three hours, six feedings in 24 hours. Since the stools had not improved under this treatment and since the diarrhœa was of such a severe grade and long duration, protein milk was resorted to.

Treatment.—Food prescribed:

Protein milk, 4 oz. (increased to 6 oz. if well borne) every 3 hours, at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.

August 21 (4 days later): Weight, 16 lb. 3 oz.
Loss, 5 oz.

General Condition.—As at the last visit.

Stools.—Three smooth, pasty stools, light yellow in color, of normal consistency, with small amount of mucus.

Vomiting.—None.
Appetite.—Extremely hungry.
Sleep.—Good at night.
Temperature, 98.6° F.
Treatment.—Food prescribed:

Protein milk, 8 oz. every 3 hours, 6 feedings in 24 hours.

The milk was still continued, though the stools were fairly normal, because the mucus had not entirely disappeared from the stools.

August 25 (4 days later): Weight, 16 lb. 6 oz.
Gain, 3 oz.

General Condition.—As above.
Stools.—One hard, smooth, pale yellow stool a day.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Excellent.
Temperature, 98.6° F.
Treatment.—Food prescribed:

Milk	16 oz.	boiled	Divide into 6 feedings. Feed 6½ oz. every 3 hours.
Water	32 oz.		
Sugar	0 oz.		

Each day the milk is to be increased four ounces and the water decreased the same amount and later sugar added until the proper amount of food is given to fulfil the caloric requirements.

With this treatment there was no recurrence of diarrhœa.

Another instance of the successful use of protein milk is shown in

Case XXV

(Also illustrating the use of protein milk where the others failed)

September 16: Age, 7½ months. Weight, 15 lb. 3 oz.

General Condition.—Well nourished, well developed, good color. Buttocks badly chafed. Needs 45 calories per pound per day.
Stools.—For one week, four or five green or yellow, watery stools with a good deal of mucus but no curds or blood.
Vomiting.—None.
Appetite.—Poor; leaves one or two ounces at each feeding.
Sleep.—Fretful.
Temperature, 98.6° F.
Chief Complaint.—Diarrhœa.
Previous Food.—Has had the proper milk and water mixtures until a week ago, when, on account of diarrhœa, one-third milk and two-thirds water were given for three days, then increased to half milk and half water, boiled, without sugar, eight ounces at a feeding, five feedings in 24 hours. Under

this treatment there was no improvement in the diarrhœa after one week's trial.

Treatment.—On account of the persistence of the diarrhœa with the boiled milk feeding, protein milk was given, five ounces every three hours, six feedings in 24 hours.

September 19 (3 days later): Weight, 15 lb.
Loss, 3 oz.

General Condition.—The same.

Stools.—Yesterday, two smooth, hard, yellow stools, without mucus; today none.

Vomiting.—None.

Appetite.—Refused protein milk at first; well taken the second day.

Sleep.—Good.

Temperature, 98.6° F.

Treatment.—Food prescribed:

Milk	21 oz.	boiled	Divide into 6 feedings of 6 oz. each. Feed every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M.
Water	21 oz.	boiled	
Sugar	0		

With these boiled milk feedings the stools remained constipated for a number of days, so that milk and sugar could be rapidly increased to fulfil the caloric needs.

In many cases of MARASMUS where there is diarrhœa protein milk will be found useful. Nothing, however, is comparable to breast milk if it can be secured for such cases. Even breast milk is not a universal panacea for all cases ot marasmus. It is not astonishing, then, that the most careful administration of protein milk or any other food is often without avail.

Many severe cases of marasmus show the "paradoxical weight reaction" of Finkelstein; that is, the more food that is given them, the more do they lose in weight. This may be true even when there is no diarrhœa, and when the stools are normal or even constipated. When this "paradoxical weight reaction" occurs, very small quantities of food should be used, in order, if possible, to raise the infant's tolerance for food.

A startling phenomenon may occasionally be observed in very sick infants who are fed upon a food containing

no sugar and little salts over too long a period of time. The infant suddenly appears to go into collapse. This is probably from the gradual and continuous loss of body fluids as a result of the prolonged absence of the sugar and salts from the food. When this occurs, the addition of sugar to the food in fairly large quantities will overcome the collapse, and the infant will gain one-half to one pound in weight in the next twenty-four hours, due to water retention through osmosis; that is, the sugar attracts water and prevents it from being excreted in the urine. This water retention will sometimes save an infant's life, and it is well to try it in cases that go into collapse while being fed a sugar-and-salt-free diet, even though the sugar is contra-indicated by the diarrhœa.

Blood transfusions are often indicated in marasmus and in difficult feeding cases that have suffered repeated attacks of diarrhœa or other gastro-intestinal disturbances. By transferring the blood of a healthy adult into the veins of such an infant, the needed stimulus is sufficient to start the patient on the road to recovery. Transfusions have fallen into disrepute because they have been used in unsuitable cases and because they have not always been used in conjunction with the proper dietetic treatment.

Calcium Caseinate Mixtures

Calcium caseinate is a dry powder made by a number of commercial houses, and sold in packages which contain a definite amount of the powder, weighed out for convenience in making the food. Casec made by Mead Johnson, and Protolac made by the Dryco Co., have ⅓ ounce in each package, Larosan made by Roche has ⅔ ounce in each package. The powder, which is a caseinate of calcium is a milk product made by extracting the whey, milk sugar and fat, and drying the residue which is casein.

The complete food as given to infants must be prepared

with whole milk, or skimmed milk and water, boiled in the following manner: Mix one or two packages (usually ⅔ ounce) in enough cold water to make a thin paste. Put the required amount of milk and water over the direct flame in a sauce pan, and when it has come to the boiling point, (constantly stirring to prevent the scum formation), add the paste to it. Boil actively for ten minutes. Take off the stove and stir five minutes. Add sugar if ordered, and divide evenly into the required number of bottles.

The calcium caseinate mixtures may be used in the severer types of diarrhœa which require a protein food. They have the advantage of being easier to make than Eiweiss Milch, they taste better (not being sour), and the calcium salt prevents the loss of weight which is so apt to occur when plain milk and water mixtures are used without sugar. No sugar is added until the stools become firm and smooth, then sugar is begun in small quantities, and gradually increased until the caloric needs are supplied. It has been the author's custom to continue the calcium caseinate until the sugar has been increased to the maximum and to continue it indefinitely in cases where there has been a former prolonged severe diarrhœa, or in cases where sugar tends to loosen the stools.

Case XXVI

(Ilustrating the use of calcium caseinate mixtures in a case of prolonged severe diarrhœa.)

March 14: Age, 4 months 3 weeks. Weight, 10 lbs. 6 oz.
Birth weight unknown.

General Condition.—Emaciated, pale, distention of abdomen.
Stools.—For three weeks five to six yellow, watery or semi-solid, sour-smelling, no mucus, curds or blood.
Vomiting.—None.
Appetite.—Good, takes all the food offered.
Sleep.—Cries and frets a lot.
Temperature, 98.6° F.
Chief Complaint.—Diarrhœa, failure to gain, fretfulness.

Previous Food:

Eagle Brand Condensed Milk ..	2 teaspoonfuls.	Fed 5 oz. every 3 hours.
Water	5 oz.	

Treatment.—Food prescribed:

Skimmed milk ...	24 oz.	boiled	Divide into 7 feedings. Feed at 6, 9, 12 A.M., 3, 6, 10 P.M., 2 A.M.
Water	20 oz.		
Calcium Caseinate	1 oz.		
Sugar	0		

March 21 (7 days later): Weight, 10 lbs. 12 oz.
Gain, 6 oz.

General Condition.—Unchanged.
Stools.—3 firm, smooth, homogeneous, yellow, normal.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Better.
Temperature, 98.6° F.

Treatment.—Food prescribed:

Skimmed Milk ..	26 oz.	boiled	Divide into 7 feedings. Feed at 6, 9, 12 A.M., 3, 6, 10 P.M. 2 A.M.
Water	20 oz.		
Calcium Caseinate	1 oz.		
Dextri Maltose .	¼ oz.		

March 27 (6 days later): Weight, 10 lbs. 12 oz.
No gain.

General Condition.—Improved.
Stools.—2 firm, normal.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.
Temperature, 98.6° F.

Treatment.—Food prescribed:

Skimmed Milk ..	26 oz.	boiled	260 cals.	Divide into 7 feedings. Feed at 6, 9, 12 A.M., 3, 6, 10 P.M., 2 A.M.
Water	20 oz.			
Calcium Caseinate	1 oz.		50 cals.	
Dextri Maltose ..	½ oz.		60 cals.	
			370 cals. or 34 cals. per lb.	

April 3 (7 days later): Weight, 10 lbs. 15 oz.
Gain, 3 oz.

General Condition.—Improved.
Stools.—2 firm, normal.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.
Temperature, 98.6° F.

Treatment.—Food prescribed:

Skimmed Milk ..	26 oz.	boiled	260 cals.	Divide into 7 feedings.
Water	20 oz.			Feed at 6, 9, 12 A.M.,
Calcium Caseinate	1 oz.		50 cals.	3, 6, 10 P.M., 2 A.M.
Dextri Maltose .	¾ oz.		90 cals.	
			400 cals. or 36 cals. per lb.	

April 12 (9 days later): Weight, 11 lbs. 3 oz.
Gain, 4 oz.

General Condition.—Improved.
Stools.—2 firm, normal.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.
Temperature, 98.6° F.

Treatment.—Food prescribed:

(Top 4 oz. removed) Milk ..	28 oz.	boiled	336 cals.	Divide into 7 feedings. Feed at 6, 9, 12 A.M.,
Water	18 oz.			3, 6, 10 P.M., 2 A.M.
Calcium Caseinate	1 oz.		50 cals.	
Dextri Maltose ..	1 oz.		120 cals.	
			506 cals. or 46 cals. per lb.	

April 19 (7 days later): Weight, 11 lbs. 10 oz.
Gain, 7 oz.

General Condition.—Improved.
Stools.—2 firm, normal.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.
Temperature, 98.6° F.

Treatment.—Food prescribed.

(Top 3 oz. removed) Milk . 28 oz.	boiled	470 cals.	Divide into 7 feedings. Feed at 6, 9, 12 A.M., 3, 6, 10 P.M., 2 A.M.
Water .... 18 oz.			
Calcium Caseinate 1 oz.		50 cals.	
Dextri Maltose ..1¼ oz.		150 cals.	
		670 cals. or 58 cals. per lb.	

May 3 (14 days later): Weight, 12 lbs. 7 oz.
Gain, 13 oz.

General Condition.—Improved.
Stools.—2 firm, normal.
Vomiting.—None.
Appetite.—Good, takes all the food.
Sleep.—Good.
Temperature, 98.6° F.

Treatment.—Food prescribed:

(Top 2 oz. removed) Milk . 28 oz.	boiled	476 cals.	Divide into 6 feedings. Feed at 6, 9, 12 A.M., 3, 6, 10 P.M.
Water .... 18 oz.			
Calcium Caseinate 1 oz.		50 cals.	
Dextri Maltose ..1½ oz.		180 cals.	
		706 cals. or 56 cals. per lb.	

May 17 (14 days later): Weight, 13 lbs. 2 oz.
Gain, 11 oz.

General Condition.—Good.
Stools.—2 firm, normal.
Vomiting.—None.
Appetite.—Excellent.
Sleep.—Good.
Temperature, 98.6° F.

Treatment.—Food prescribed:

(Top 1 oz. removed) Milk . 28 oz.	boiled	532 cals.	Divide into 6 feedings. Feed at 6, 9, 12 A.M., 3, 6, 10 P.M.
Water .... 18 oz.			
Calcium Caseinate ⅔ oz.		35 cals.	
Dextri Maltose ..1½ oz.		180 cals.	
		747 cals. or 57 cals. per lb.	

May 31 (14 days later): Weight, 14 lbs.
Gain, 14 oz.

General Condition.—Excellent.
Stools.—2 firm, normal.
Vomiting.—None.
Appetite.—Good, takes all the food.
Sleep.—Good.
Temperature, 98.6° F.

Treatment.—Food prescribed:

Whole Milk	32 oz.	boiled	640 cals.
Water	16 oz.		
Calcium Caseinate	0		
Dextri Maltose ..	1½ oz.		180 cals.
			820 cals. or 58 cals. per lb.

Lactic Acid Milk

Milk may be soured in three ways, by age, by culturing with milk souring bacteria or by adding U. S. P. lactic acid, two teaspoonfuls to the quart. The exact methods of preparation are described on page 152. The author's preference is for milk soured by culture.

Indications.—(1) It may be used in place of boiled milk in many instances; (2) coeliac disease; (3) marasmus; (4) other conditions where the normal acidity of the stomach is diminished.

Acidified milk is one of the fads of the day. It is a very valuable food for infants but it should not be considered a panacea for all their ills. Those who have not believed in boiled milk have discovered at last that raw sweet cow's milk was not intended for the infant's stomach. They have adopted the plan of souring it and found that it is more easily digested than raw sweet milk, which is undoubtedly true. These authorities use it as a routine in infant feeding, just as the author uses boiled milk as a routine. There is nothing in the literature nor in the author's experience with soured milk to indicate that, except where there is a lowered acidity of the stomach, it is

an improvement over boiled milk which he prefers for many reasons.

Coeliac Disease.—Soured skimmed milk is the remedy par excellence in coeliac disease, but since one ounce of fat-free milk has only ten calories or one-half as much food value as one ounce of whole milk, large quantities must be given at frequent intervals as soon as the baby will take it—as much as eight or ten ounces every three hours, night and day, up to two quarts in twenty-four hours. Unfortunately, lack of appetite or failure to take much of any food is seen in many instances at certain stages of the disease, but an exclusively lactic acid milk diet eventually remedies this anorexia and often brings about an enormous appetite which is almost impossible to satisfy. When fat-free buttermilk has been given for some time and the stools have become firm and smooth, the vomiting has ceased and the appetite is excellent, sugars or starches may be very sparingly added to the diet. A small amount of Karo syrup (dextrine and maltose) or some other form of sugar may be added to the buttermilk. If it is tolerated it may be gradually increased, but if it is not tolerated, sugar should never be tried again until recovery has taken place.

Where sugar is not tolerated, as shown by a recurrence of loose stools, vomiting and failure of appetite, starches may be used in its place. Arrowroot gruel (made with one-half fat-free milk and one-half water and as thick as the baby will take it, to increase the caloric value) may be tried, a few ounces a day, until the tolerance for it is tested, and later increased up to the point where a gain in weight may be made. At best, the progress is slow, taxing the patience of the family and physician alike. One who has treated many of these babies and has the courage of his convictions, may look forward to the time when a definite and steady improvement will take place.

When a continuous improvement of the stools and other symptoms have been brought about, other articles of diet may be added such as hard boiled eggs, scraped meat, vegetable purees, cooked fruits, and eventually all foods except fats. Fats must be kept out of the diet for several years, for coeliac disease is liable to recur even after a year of splendid progress.

The statement has been made that these babies do not grow and thrive later on in life, but this is not true in the majority who are skillfully treated.

Case XXVII

(Illustrating the treatment of Coeliac Disease with Lactic Acid Milk.)

October 15: Age, 1 year 2 months. Weight, 12 lb. 12 oz.
Weight, 5 months ago, 18 lb.

General Condition.—Emaciated to last degree, skin hanging in wrinkled folds on emaciated extremeties that had once been fat. Extreme palor, abdomen tremendously large from distention, ten large, prominent teeth, long, fine, silky hair that gives an appearance of older childhood. Muscular weakness so extreme that she could not lift her head or legs from the bed. Skin rough, dry and inflamed from over-dressing, plus malnutrition.

Stools.—Have been loose most of the time for past five months. Recently 2 to 8 green, watery to semi-solid, much mucus, curds and undigested food, no characteristic odor.

Vomiting.—Beginning with a vomiting attack five months ago there has been vomiting off and on ever since, until the past two months, when only occasional vomiting occurred.

Appetite.—Capricious and changeable, usually poor. Recently will take only three ounces at a feeding.

Sleep.—Lanquid, fretful, whiney.

Temperature, 97.4° F.

Chief Complaint.—All the above.

Previous Food:—Too numerous to enumerate, including cereals, vegetables, many different formulas. At present, Barley gruel (5 tablespoonfuls to one quart of water) and Buttermilk, one quart cooked with 4 tablespoonfuls of cream of rice. Fed 3 oz. every 4 hours, 5 feedings in 24 hours (15 oz. in all).

Treatment.—Food prescribed:

Fat-free butter milk, commercially prepared by Walker-Gordon, by souring undiluted skimmed milk.	5 oz. every 3 hours night and day, 40 oz. in 24 hours.

October 18 (3 days later): Weight, 13 lb. 3 oz.
Gain, 7 oz.

General Condition.—Unchanged.
Stools.—8 yellow, becoming firm, some mucus.
Vomiting.—None.
Appetite.—Takes all the food, 40 oz.
Sleep.—Better.
Temperature, 98° F.

Treatment.—Food prescribed:

Fat-free Buttermilk.	Feed 8 oz. every 3 hours. 8 feedings, 64 oz. in 24 hours.

October 25 (7 days later): Weight, 14 lb. 8 oz.
Gain, 1 lb. 5 oz.

General Condition.—More comfortable.
Stools.—*3 large, firm, smooth, homogenous, no mucus.*
Vomiting.—None.
Appetite.—Takes 2 quarts a day, 64 oz.
Sleep.—Good.
Temperature, 98.6° F.

Treatment.—Food prescribed:

Fat-free Buttermilk, and small baked potato.	Feed 8 oz. every 3 hours night and day, 64 oz. in 24 hours.

November 1 (7 days later): Weight, 14 lb. 4 oz.
Loss, 4 oz.

General Condition.—Unchanged.
Stools.—*4 to 6 semi-solid, green, partially undigested, due to the starch in the potato.*
Vomiting.—None.
Appetite.—Hungry, takes all the food.
Sleep.—Fretful at times from colic.
Temperature, 98.6° F.

Treatment.—Food prescribed:

Fat-free Buttermilk. Stop Potato till stools are normal again.	Feed 10½ oz. at 6, 9, 12 A.M., 3, 6, 10 P.M.

November 15 (14 days later): Weight, 14 lb. 14 oz.
Gain, 10 oz.

General Condition.—Improved.
Stools.—Stools loose off and on until potato was discontinued permanently.
Vomiting.—None.
Appetite.—Excellent.

Sleep.—Good.

Temperature, 98.6° F.

Treatment.—Food prescribed:

Fat-free Buttermilk 2 qts. daily. In addition, arrowroot gruel made with 1 pint skimmed sweet milk, 1 pint of water and 9 level tablespoonfuls of arrowroot flour.

Feed buttermilk as before and also give 4 oz. of gruel, first 1, then 2, 3 and 4 times a day.

November 22 (14 days later): Weight, 16 lb.
Gain, 1 lb. 2 oz.

General Condition.—Much improved.

Stools.—1 firm, hard, normal until yesterday when they became loose again.

Vomiting.—None.

Appetite.—Excellent.

Sleep.—Good.

Temperature, 98.6° F.

Treatment.—Food prescribed: As at last date, except stop arrowroot gruel till stools are normal again.

December 20 (4 weeks later): Weight, 17 lb. 12 oz.
Gain, 1 lb. 12 oz.

General Condition.—Much improved.

Stools.—Stools looser for a day or two off and on but always became firm when gruel was stopped. Failed to gain in weight when no gruel was given, even when buttermilk was increased to 2½ qts. daily.

Vomiting.—None.

Appetite.—Excellent.

Sleep.—Good.

Temperature, 98.6° F.

Treatment.—Food prescribed:

Fat-free Buttermilk 2½ qts. daily. Arrowroot gruel when stools are not loose.

Feed every 3 hrs. as before.

January 17 (4 weeks later): Weight, 17 lb. 14 oz.
Gain, 2 oz.

General Condition.—Unchanged. Progress unsatisfactory.

Stools.—Stools were loose for a day or two a number of times during the last month, but were always controlled by an exclusively buttermilk diet. Various kinds of sugars and starches were tried but all loosened the stools, the arrowroot least of all. Pineapple juice, orange juice, spinach water did the same.

Treatment.—Food prescribed:

Unchanged.

March 13 (2 months later): Weight, 20 lb. 2 oz.
Gain, 2 lb. 2 oz.

General Condition.—Much improved, sits up alone, looks rosy and strong.

Stools.—Usually firm, normal stools, but occasionally gruels had to be stopped on account of loose stools.

Vomiting.—None.

Appetite.—Excellent.

Sleep.—Good.

Temperature, 98.6° F.

Treatment.—Food prescribed:
Unchanged.

May 6 (7 weeks later): Weight, 17 lb. 8 oz.
Loss, 2 lb. 8 oz.

General Condition.—There has been a relapse of all symptoms occurring soon after last date and a corresponding disappointment in the general condition.

Stools.—10 to 12 loose, watery stools soon after last date.

Vomiting.—For 2 weeks after last date vomited a lot.

Appetite.—Failed after last date. Good for past two weeks.

Sleep.—Good.

Temperature, 98.6° F.

Treatment.—Food prescribed:
Fat-free Buttermilk 2½ quarts.
Arrowroot gruel made with ½ skimmed milk.
1 Hard boiled egg, grated.

August 5 (3 months later): Weight, 25 lb.
Gain, 7 lb. 8 oz.

General Condition.—Happy, rosy, fat, 16 teeth, stands and walks.

Stools.—2 firm, normal, ever since last date.

Vomiting.—None.

Appetite.—Excellent. Eats everything offered.

Sleep.—Excellent.

Temperature, 98.6° F.

Treatment.—Food prescribed:
To the diet of last date add one at a time, apple-sauce, scraped beef, vegetables, cereals, breadstuffs. No Fats or Sugars for at least a year.

CHAPTER XI

CARBOHYDRATE FOODS IN THE TREATMENT OF DIARRHŒA.

Carbohydrate Foods

(a) Barley gruel.

(b) Sugar solutions.

(c) Thick gruels of various kinds, such as cornstarch, arrowroot, farina etc., fed with a spoon. Breadstuffs.

Indications.—(1) Putrefactive diarrhœa; (2) over-feeding; (3) mild types of infectious diarrhœas; (4) dysentery; (5) severe infectious diarrhœa in small, young infants (cholera infantum); (6) dehydration; (7) acidosis; (8) infants not improved by a thorough trial of protein foods; (9) chronic diarrhœas in children old enough to eat from the spoon.

Carbohydrates are the foods of choice wherever the intestinal flora is predominately putrefactive for the reasons given in the chapter on classification and diagnosis of diarrhœas. Very sick infants can digest carbohydrates, especially weak sugar solutions, with less effort than milk foods, and this is equally true of older children during the course of a severe infectious disease. Acidosis calls for carbohydrates, especially sugar solutions, because sugars spare the combustion of body fats, the products of which create acetone bodies. Dehydration calls for sugars because sugar in the blood and tissues attracts water and prevents the "drying up" or loss of fluids which is the cause of death in many acute diarrhœas. When it has been determined that a carbohydrate food is indicated for

an individual case, the next problem is which of the above foods is best suited for the infant at hand.

It is said that barley has no advantage over other cereals, but this is not entirely true. Barley flour can be purchased at any druggist's, in sealed cans and since it has been pre-cooked in the dry state, and the starch granules broken up by exposure to a high temperature, it is easily digested and may be quickly prepared by twenty minutes' boiling. Another argument in its favor is that it has given satisfactory clinical results for many years. A plain barley gruel made with water has the double effect of resting the stomach and intestines, and of changing the intestinal flora from putrefactive to a fermentative one. Before absorption, starches must be changed into sugar in the intestinal tract. This change takes place slowly as the food moves through the bowel, so that when starch foods are ingested there is never a large amount of sugar in the intestines at any one time, since it is absorbed as soon as it has been converted into the end product maltose and dextrin. This leaves less fermentable material for the fermentative bacteria to work upon and theoretically, enough for them to gain the ascendency over the putrefactive bacteria. Even under one month of age infants can digest small amounts of starch, but not until four months or more can large amounts be utilized. Starch that is not digested passes out in the stools as such.

Barley gruel without the addition of milk should never be used very long at any age, but fortunately this is not necessary, for as soon as it has been demonstrated that gruel is bringing about an improvement, milk may be used with it. In certain cases of putrefactive diarrhœa the improvement with plain barley gruel may be immediate, the stools decreasing in number or stopping altogether in a

few hours, in which event the therapeutic test points the way for its continued use with the addition of milk to the mixture. Begin with a small amount of milk, usually one-third milk and two-thirds water, and boil the barley for twenty minutes in the milk and water.

The types of cases in which barley gruel is indicated are those not badly undernourished, since a weak gruel made with water has very little food value and involves starvation until milk is added. Slightly under-nourished and over-fed infants may safely be thus treated provided there is no fermentation (as indicated by sour-smelling stools and other accompanying symptoms elsewhere described). Infants that are toxic and very ill or much emaciated should receive sugar solutions and infants old enough to eat from the spoon should have a variety of thick gruels described later.

For small infants under four months of age the barley gruel should be made weak, one level tablespoonful to the quart of water. For the average-sized infant, over four months of age, two or three level tablespooonfuls of the flour to one quart of water may be used, and for still older infants, eight or nine months of age, four or five tablespoonfuls to the quart. Use barley flour, which can be bought at any drug store, either Robinson's, Brooks' or the Cereo Barley. Ordinary pearl barley can be used but it requires at least three hours cooking instead of the twenty minutes stated below.

Take the stated amount of barley and gradually stir into it enough cold water to make a thin paste, mixing it until there are no lumps. Measure out the water, put it on the stove in a saucepan and when it has begun to boil, slowly add the paste to it, stirring it until it has come to a boil again. Add ¼ teaspoonful of table salt and let it boil

slowly (simmer) for twenty minutes. Strain and add enough water to it (if necessary) to make the required number of ounces of barley. The gruel should be salted to taste, but at the beginning no sugar or milk or any other ingredient should be added to it. It should be given in the quantity and at the intervals suitable for the infant's age and size (see page 74). Since the infant is apt to be very hungry at this stage it may be given every two hours to appease the appetite, provided there is no vomiting. Often it is not necessary to use the barley longer than twenty-four hours, and it should never be used without the addition of milk longer than forty-eight hours in small or weak infants under four months of age. The older and stronger the infant, the longer an exclusive gruel diet may be safely continued, because sufficient starch may be given to maintain the nutrition.

Sugar and water solutions are beneficial and even life saving in severe infectious diarrhœas in small, young infants who are not able to sustain life for any prolonged period on weak barley gruel or who are not old enough to eat and digest large quantities of thick gruels, cereals and breadstuffs. Various authorities have recommended lactose solutions, Mellen's food, glucose, corn syrup, (Karo) and other forms of sugars. The author perfers malted milk to any of these with the exception of glucose solution in desperately sick infants. Malted milk is usually well taken, it does not cause vomiting as a rule, and it contains enough protein so that it may be safely used exclusively for several days if need be.

Infants old enough to eat from the spoon may be fed with thick gruels and breadstuffs when a carbohydrate diet is indicated.

The following gruels may be given: cornstarch, arrow-

root, rice flour, barley, or browned flour. To make browned flour, ordinary wheat flour should be browned in the oven being careful to use a plate or baking pan that has never had grease upon it. To make any of the gruels take 4 tablespoonfuls of the flour and stir into it enough cold water to make a thin paste, mixing it until there are no lumps. Measure out 8 ounces of skimmed milk and 8 ounces of water in a saucepan, bring to the boil and while boiling add the thin paste to it, add a quarter teaspoonful of table salt and boil actively over the direct flame for 10 minutes. Then put into a double boiler and cook for one hour. Make fresh gruels at least twice during the day so that the baby will not tire of them. However, if the baby likes one gruel better than another it may be given oftener. Variety both in gruels and breadstuffs is very desirable. Besides the various gruels white bread (without butter) sliced thin and toasted hard and dry in the oven, may be given or very stale white bread which is cut into slices and allowed to dry two to three days. A bread pap may be made of either of these by moistening toast or stale bread, with boiling water and putting it on the stove to cook a moment. It may be given thick or thin according to the child's preference. The following crackers may be given: arrowroot, uneeda biscuits, saltines, zweiback or rusk.

Nothing whatever that is not on this list is to be given. No milk is to be given to drink, until the diarrhœa has been controlled and the stools have become firm and smooth or even constipated, when boiled milk may be given from the cup in small quantities at first and gradually increased.

Putrefactive diarrhœa is seldom seen in very young infants, except in cases where the infant has been fed upon a sugar-free diet or a diet very low in sugar. Older infants who receive a larger amount of milk and less sugar in the

food, or who are getting a mixed diet, are more liable to putrefactive diarrhœa.

Carbohydrate foods are also indicated in cases that have been changed from the fermentative type to the putrefactive type of diarrhœa by omitting the sugar. They are to be used in large, well-nourished infants over six months of age that have not been benefited by protein foods on the chance that the diarrhœa is putrefactive, even though the stools do not have a putrefactive odor. In other words, it may be used as a therapeutic test to discover the variety of the diarrhœa.

Case XXVIII

(Illustrating the use of barley gruel in putrefactive diarrhœa)

August 27: Age, 8 months. Weight, 13 lb. 13 oz.

General Condition.—Poorly nourished, pale, fair musculature.
Stools.—For one week, *four or five loose, foul-smelling, moist stools, with much mucus,* no curds.
Vomiting.—None.
Appetite.—Ravenous.
Sleep.—Fair.
Temperature, 100.5° F.
Chief Complaint.—Diarrhœa.

Previous Food:
Equal parts of milk and water.

Treatment.—Food prescribed:

Barley gruel, 4 tablespoonfuls to the quart, given in the bottle and the various thick gruels fed with the spoon.

Feed every 3 hours, 6 feedings in 24 hours, at 6, 9, 12 A.M., 3, 6, 10 P.M.

August 30 (3 days later): Weight, 13 lb. 4 oz.
Loss, 9 oz.

General Condition.—The same.
Stools.—*Two brown, smooth, soft, homogeneous;* no mucus or curds.
Vomiting.—None.
Appetite.—Ravenous.
Sleep.—Good.
Temperature, 98° F.

Treatment.—Food prescribed:

Fat-free milk	24 oz.	boiled	Divide into 6 feedings. Feed 8 oz. every 3 hours, at 6, 9, 12 A.M., 3, 6, 10 P.M.
Water	24 oz.	boiled	
Barley	4 tablespoonfuls		
Sugar	0		

Thick gruels made with half fat-free milk fed with a spoon.

September 3 (4 days later): Weight, 13 lb. 4 oz.
No gain or loss.

General Condition.—The same.
Stools.—Constipated, one (with enema) smooth, hard, homogeneous.
Vomiting.—None.
Appetite.—Ravenous.
Sleep.—Fair.

Treatment.—Food given:

Fat-free milk	28 oz.	boiled	Divide and feed as before.
Water	20 oz.	boiled	
Barley	4 tablespoonfuls		
Cane sugar	½ oz.		

There was no return of the diarrhœa when the sugar was gradually increased up to 1½ ounces in the twenty-four-hour amount.

This infant was very much undernourished, weighing less than 14 pounds at eight months of age. At the time of the first visit the stools were loose and foul-smelling, showing that the diarrhœa had changed to the putrefactive type. Gruels were then given, and four days later the stools were normal—in fact, this diet caused constipation. For the constipation, the mother was cautioned against giving a cathartic. If special care is not taken to give such instructions, a mother's fear of constipation will generally lead her to give a dose of castor oil, starting up the diarrhœa again, as the bowels are still in an irritable condition.

Overfeeding, when it occurs in older, well-nourished infants, may be treated by giving barley gruel for a short period to rest the stomach and bowels then returning to a weak milk mixture which is gradually increased to fulfill the caloric needs. Provided there is not a fermentative diarrhœa, a diet of weak barley gruel does no harm to them as it does to smaller, weaker babies, and the rest given to the digestive apparatus by a gruel diet is often effective. A cathartic should not be administered.

CASE XXIX

(Illustrating the use of barley gruel in overfeeding)

June 29: Age, 8 months. Weight, 19 lb.

General Condition.—Fat, good color, somewhat rhachitic, good musculature.
Stools.—For four days, three or four large, yellow, watery, with much mucus, no curds.

Vomiting.—None.
Appetite.—Leaves two or three ounces several times a day.
Sleep.—Restless.
Temperature, 98.6° F.
Chief Complaint.—Diarrhœa.

Previous Food:

Milk	38 oz.	boiled	(760 cals.)	Feed 8½ oz. every 3 hours, 6 feedings in 24 hours.
Barley gruel.	14 oz.	boiled	(50 cals.)	
Cane sugar..	2½ oz.		(300 cals.)	

1110 cals., or 58 per pound; the caloric requirements of this fat baby would be only 40 to 45 per pound.

Treatment.—Food prescribed:

Barley gruel: 2 tablespoonfuls (½ oz.) to the quart. Feed 8 oz. every 3 hours.

June 30 (1 day later): Weight, 18 lb. 12 oz.
Loss, 4 oz.

General Condition.—The same.
Stools.—Three smooth, soft, brown stools, with no mucus or curds.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good at night, restless during the day.
Temperature, 98.6° F.

Treatment.—Food prescribed:

Milk	20 oz.	boiled	(400 cals.)	Divide into 5 feedings of 8 oz. each Feed every 4 hours at 6, 10 A.M., 2, 6, 10 P.M.
Water	20 oz.	boiled		
Sugar	0			

400 calories, or about 21 per pound.

July 5 (5 days later): Weight, 18 lb. 14 oz.
Gain, 2 oz.

General Condition.—The same.
Stools.—One large, light yellow, smooth, soft.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	24 oz.	boiled	(480 cals.)	Given in same quantities and at same intervals as before.
Water	16 oz.	boiled		
Sugar	½ oz.		(60 cals.)	

540 calories, or 28 per pound.

As the sugar and milk were increased to the quantity required to fulfil the caloric needs, a normal gain in weight was made and the stools remained normal.

Mild types of infectious diarrhœa are more common than severe cases, and are usually caused by bad milk or some contaminated food. They have a sudden onset, attended usually with vomiting and intestinal pain, though one or both of the last two symptoms may be lacking. They may occur in infants who are doing well or in those who have been suffering from intestinal or gastric indigestion. At the onset it is impossible to tell whether a mild or severe case is commencing, since those diarrhœas that are most easily overcome often begin with high temperature, a toxic appearance of the baby, and all the symptoms of intoxication. The stools are usually very numerous, from four to twelve in twenty-four hours, and, as a general rule, the fewer the stools at the onset, the milder the diarrhœa. This, however, is not true in certain extremely toxic babies whose bowels do not move at all, or only very slightly because of paralysis of the intestines due to the toxemia. The stools are usually green and watery—sometimes frothy, due to gas—and contain mucus, curds, and undigested food. They may be foul, sour, or odorless, and are more usually acid than alkaline. Blood is never present. In previously healthy children such an attack is usually of brief duration—if the cause is located and proper treatment instituted. In more delicate infants, while the attack itself is not serious, it is apt to pave the way for more dangerous intestinal disturbances.

A cathartic should be given at once, followed by a complete rest from food, allowing nothing by mouth except water for from twelve to twenty-four hours. After that, barley gruel may be given for a day or two, and then milk and water feedings begun after the bowels have cleared up entirely.

Case XXX

(Illustrating the treatment of a mild type of infectious diarrhœa)

August 8: Age, 7 months. Weight, 15 lb. 7 oz.

General Condition.—Fairly well nourished, high color, febrile appearance: looks rather sick.

Stools.—In the last twelve hours has had four loose, watery, green stools, with much mucus and some curds.

Vomiting.—Once or twice at the onset.

Appetite.—Refuses food.

Sleep.—Drowsy.

Temperature, 101° F.

Chief Complaint.—Diarrhœa, with sudden onset.

Previous Food:

Milk ..... 28 oz. (560 cals.)	unboiled	Fed 8 oz. every 3 hours, 6 feedings in 24 hours.
Water .... 20 oz.		
Cane sugar. 1½ oz. (180 cals.)		
740 calories, or 48– calories per pound.		

Treatment.—Two teaspoonfuls of castor oil. Nothing else by mouth except water for twelve hours, then

Barley gruel.. 1 tablespoonful (¼ oz.) to the quart.	Give 5 oz. every 3 hours, 6 or 7 feedings in 24 hours.

August 9 (1 day later):

General Condition.—Improved.

Stools.—After castor oil, three green, watery, foul-smelling stools, with much mucus. To-day, two brown, smooth, watery movements.

Vomiting.—None.

Appetite.—Takes all the barley.

Sleep.—Good.

Temperature, 98° F.

Treatment.—Food prescribed:

Milk	16 oz.	boiled	Divide into 6 feedings. Feed 8 oz. every 3 hours, at 6, 9, 12 A.M. and 3, 6, 10 P.M.
Water	32 oz.	boiled	
Barley flour ...	3 tbs.		

320 calories, or 16 per pound.

August 11 (2 days later):

General Condition.—The same.

Stools.—Three yesterday, one to-day. Normal.

Vomiting.—None.

Appetite.—Ravenous.

Sleep.—Good at night, restless during the day.

Treatment.—Food prescribed:

Milk	24 oz.	boiled	Fed in similar quantities and intervals as above.
Water	24 oz.	boiled	
Barley flour ...	3 tbs.		

555 calories, or 35– calories per pound.

Subsequently there was no recurrence of diarrhœa or fever, and a normal progress was made as the food was increased in strength and sugar gradually added.

Dysentery.—The physician is familiar with these forms of severe, acute, bloody diarrhœa which occur suddenly in an infant who has been previously well, or in an infant who has been suffering from gastric or intestinal indigestion. The microörganisms (Shiga's dysentery bacillus, Flexner's dysentery bacillus, typhoid, streptococci, and probably other varieties of bacteria) are taken in through the mouth, usually in bad milk. Water may be a possible source of infection, and flies, unclean vessels, nipples, bottles, contaminated milk most certainly are.

The infant is suddenly overwhelmed and prostrated with a severe infection. There is high temperature, 104° to 106° F., usually severe vomiting and numerous loose stools, composed chiefly of mucus and blood, after the fecal matter already in the intestines has been evacuated.

A cathartic should be given only at the very beginning of the diarrhœa. Whether the diarrhœa has progressed so far as to render it inadvisable to give a cathartic, depends much upon the presence of undigested food in the stools and upon the number of stools that have occurred since the onset. If there is no fecal matter in the stools and if there have already been ten or twelve stools, and if no food has been taken into the stomach since the onset, a cathartic is not needed.

Plain, unsweetened water only is given for the first twenty-four hours, or longer if the vomiting has not been checked (see "Vomiting," p. 208). This treatment is advisable for two reasons: *First,* because of the absolute rest given to the intensely inflamed gastro-intestinal tract; and, *Second,* food of any sort may act as a culture media for the bacteria. In severe cases, where the body fluids are being drained rapidly through vomiting and frequent evacuations, it becomes necessary to inject a normal saline solution under the skin (hypodermoclysis) into the peritoneal cavity or directly into the veins.

After the twenty-four hours of plain water, a carbohydrate is given in the form of a weak barley gruel, upon the theory that some of the microörganisms in the intestines are thus changed to a fermentative type. Fermentative bacteria prevent the formation of toxins and produce acids which are unfavorable to the growth of the dysentry bacillus.

The barley gruel may be continued for one or two days if the infant is strong enough to stand the underfeeding

which it entails. Older infants (over six months of age), if they have been well nourished formerly, may subsist upon a gruel diet for a longer period. Younger infants cannot do so without an excessive loss in weight, and when a carbohydrate diet is indicated a sugar solution, such as glucose, or malted milk must be given. Severe cases of dysentery occurring in infants over seven months of age are best treated with a varied starch diet, after the initial period of starvation, giving as much starch as the infant will take. Browned flour gruel, cornstarch gruel, farina, arrowroot, and rice flour gruel all may be given. Unsweetened zweiback, plain crackers or toast, without butter or milk, and bread pap are very useful and often gratefully taken. When the stools have become normal, milk may be gradually added to the diet.

The following case is one of a moderately severe dysentery, the fever lasting for nearly a week:

Case XXXI

(Illustrating the use of the carbohydrate diet in a case of moderately severe dysentery)

August 15: Age, 10 months. Weight, 20 lb.

General Condition.—Well nourished and developed, looks sick and toxic.

Stools.—For fourteen hours, fifteen to twenty loose, for the last two or three hours chiefly composed of mucus and blood, no curds or fecal matter.

Vomiting.—Every few minutes since onset of diarrhœa.

Appetite.—Thirsty; has had water and no food.

Sleep.—None since onset.

Temperature, 104.5° F.

Chief Complaint.—Diarrhœa.

Previous Food.—This infant was bottle-fed and had done well since two months of age on proper milk mixtures. At the time of this illness he was at a summer resort where the milk supply was not good, the milk being allowed to stand in cans before bottling for distribution.

Treatment.—No cathartic was given. One-half teaspoonful of sodium bicarbonate was added to eight ounces of water. Every fifteen or twenty minutes, one-half ounce of this was allowed until the vomiting subsided. After this, plain water was given *ad libitum*.

August 16 (1 day later):

General Condition.—Still looks sick and toxic.
Stools.—Ten to fifteen loose, chiefly composed of mucus and blood.
Vomiting.—None for six hours; retains four ounces of water at a time.
Appetite.—Thirst quenched. Has taken three pints of water.
Sleep.— Little.
Temperature, 102° to 103° F.

Treatment:

Barley gruel.... 1 tablespoonful (1/4 oz.) to the quart.	Feed 2 oz. every 2 hours, increasing the amount 1 oz. at each feeding to 8 oz. every 2 hours if there is no vomiting.

August 17 (1 day later):

General Condition.—Much better.
Stools.—Four, thicker in consistency, brown, with a good deal of mucus and blood.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Fair.
Temperature, 99° to 101° F.

Treatment.—Food prescribed:

Gruels were varied with brown flour, corn-starch, farina, and arrowroot. Bread pap, dried zwieback, and toast were allowed if desired.	Feed every 2 hours, any quantity desired.

August 21 (4 days later):

General Condition.—Good.
Stools.—Two brown, soft; no blood or mucus.
Vomiting.—None.
Appetite.—Good; likes bread pap best.
Sleep.—Good.
Temperature, 98.6° F.

This infant made an uninterrupted recovery one week from the onset of a severe diarrhœa. The stools were normal, and milk was gradually added to the starch diet. Under the old plan of treatment, a diarrhœa of this sort would

Fig. 6.—Irrigating the bowel.

often continue for three, four, or even six weeks. The infant was old enough to take some solid food. The nutrition, therefore, did not suffer as much as it would have otherwise. It was also old enough to utilize the starch. Younger infants who have to be fed gruels from the bottle cannot be expected to respond so rapidly.

In some very severe cases, in spite of all treatment, the patient succumbs to the disease either during the first few days of the illness or after two, three, or even four weeks, when the infection and lack of assimilation have proved too much for the infant's powers of resistance.

Again, cases of moderate severity are seen where the blood disappears from the stools in a day or two and the temperature subsides within from twenty-four to forty-eight hours.

CASE XXXII

(Illustrating the treatment of a mild case of dysentery)

October 4: Age, 1 year. Weight, 21 lb.

General Condition.—Fat, excellent color, well developed, febrile appearance. Looks sick.

Stools.—For the last eight hours, stools every half hour, that are brown and contain some fecal matter, though largely composed of mucus and a good deal of blood.

Vomiting.—Once or twice at onset.

Appetite.—Will take nothing but water, which is retained.

Sleep.—None to-day.

Temperature, 104° F.

Chief Complaint.—Bloody diarrhœa.

Previous Food.—Whole milk and cereals.

Treatment.—One-half ounce castor oil had been given and retained at onset. Nothing but water was to be given by mouth until the next visit.

October 5 (1 day later):

General Condition.—Looks much better.

Stools.—Six in last twelve hours, pure mucus with some blood in each.

Vomiting.—None.

Appetite.—Has taken water freely.

Sleep.—Fairly good through the night.

Temperature, 98.6° F.

Treatment.—Food prescribed:

Various gruels, varying with browned flour, barley, arrowroot and corn-starch, bread pap, dried toast, unsweetened crackers; plenty of water. To be fed every three hours. Medication: Dilute hydrochloric acid, 3 drops after each feeding.

October 9 (4 days later):

General Condition.—The same.
Stools.—Three soft, brown stools with no mucus, no blood.
Vomiting.—None.
Appetite.—Extremely hungry.
Sleep.—Good at night.
Temperature, 98.6° F.

Treatment.—Food prescribed.

Carbohydrate diet as above, the gruels being made of skimmed milk and water, half and half, boiled together, giving eight ounces at a feeding, three times during the day, in place of the gruel.

The skimmed milk was gradually increased in quantity and the full milk given after three days. There was no return of the diarrhœa.

Severe Infectious Diarrhœa in Very Young Infants who require a carbohydrate diet but who cannot digest enough starchy food to maintain life, should be fed with a sugar solution. The following case shows its method of use, and the type of infant referred to. Sugar solutions are particularly indicated when there is an accompanying acidosis as seen in this patient.

Case XXXIII

(Illustrating the use of a sugar solution, Malted milk, in a young infant with severe infectious diarrhœa.)

May 18: Age, 1 month. Weight, 6 lb. 5 oz.
Birth weight, 7 lb. 8 oz.

General Condition.—Emaciated, dehydrated, fontanelle depressed, eyes sunken, acetone odor to breath.
Stools.—For 1 week 8 or 9 green, watery, mucus, foul stools. Yesterday diarrhœa became much worse.
Vomiting.—Once or twice a day.
Appetite.—Poor for past 24 hours, before that good.
Sleep.—Whines and moans constantly for past 24 hours. Restless, rolls head about.
Temperature, 101.5° F.
Chief Complaint.—Diarrhœa, fever, restlessness, loss of weight.

Previous Food:

Unsweetened Evaporated milk	5 oz.	Feed $2\frac{1}{2}$ oz. every 4 hours. 6 feedings in 24 hours.
Water	13 oz.	

Treatment.—Food prescribed:

Malted Milk	1 teaspoonful	Feed 2 oz. every 2 hours, night and day. 12 feedings in 24 hours.
Water	2 oz.	

May 19 (1 day later): Weight, 6 lb. 13 oz.
Gain, 8 oz. (water retention)

General Condition.—Facial expression improved.
Stools.—One watery, brown, foul.
Vomiting.—None.
Appetite.—Takes 2 oz. with urging and persistance.
Sleep.—Better, restlessness disappearing.
Temperature, 98.8° F.

Treatment.—Food prescribed:

Malted Milk	2 teaspoonfuls	Feed 2 oz. every 2 hours, night and day 12 feedings in 24 hours.
Water	2 oz.	

May 21 (2 days later): Weight, 7 lb.
Gain, 3 oz.

General Condition.—Much improved.
Stools.—Two semi-solid, brown, normal odor.
Vomiting.—None.
Appetite.—Takes all the food readily.
Sleep.—Good.
Temperature, 98.6° F.

Treatment.—Food prescribed:

Malted Milk	1 teaspoonful	Feed 3 oz. every 2 hours, in day 4 hours at night, 10 feedings in 24 hours.
Dryco	2 teaspoonfuls	
Water	3 oz.	

May 23 (2 days later): Weight, 7 lb. 4oz.
Gain 4 oz.

General Condition.—Improved.
Stools.—Two yellow, firm, normal.
Vomiting.—Mouthful occasionally.
Appetite.—Hungry.
Sleep.—Cries from hunger.
Temperature, 98.6° F.

Treatment.—Food prescribed:

Malted Milk	1 teaspoonful	Feed 4 oz. every 3 hours. 7 feedings in 24 hours.
Dryco	2 tablespoonfuls	
Water	4 oz.	

May 26 (3 days later): Weight, 7 lb. 6 oz.
Gain, 2 oz.

General Condition.—Much improved.
Stools.—Two firm, normal.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Still cries from hunger.
Temperature, 98.6° F.

Treatment.—Food prescribed:

Dryco	3 tablespoonfuls	Feed 4 oz. at 6, 9, 12 A.M., 3, 6, 10
Water	4 oz.	P.M., 2 A.M.

In the next 11 days there was a gain of one pound and the subsequent progress was very satisfactory.

Severe infectious diarrhœa without blood in the stools, formerly called cholera infantum, have a very definite symptomatology, differing from dysentery and the bloody diarrhœas. These symptoms are sudden onset, high rise in temperature, almost continuous vomiting, profuse diarrhœa, stools which lose their fecal character and are white in color like rice water, consisting almost entirely of serum and mucus. The constant loss of the fluids of the body because of the almost continuous vomiting and watery stools causes rapid emaciation or "drying up" of the body. The eyes are sunken, the fontanel depressed, and the infant goes quickly into collapse, sometimes dying within twelve to thirty-six hours after the onset of the disease.

The principles of the treatment of these cases are the same as those of dysentery, differing only in the details. A cathartic is contra-indicated because of excessive peristalsis, pain and loss of fluids from the numerous loose watery stools.

Water is even more urgently needed in this serious condition than it is in the other forms of diarrhœa, but on

account of the vomiting it will not be retained when given by mouth. Water in the form of a normal saline solution is given intravenously if possible, or better still intraperitoneally and, where this is not practicable, subcutaneously in the scapular region or under the breasts, or wherever the skin is loose. As much as one pint, at least, in twenty-four hours should be given, using a large antitoxin syringe.

As it usually cannot be retained by mouth, all medication must be given hypodermically. Grain $\frac{1}{300}$ to $\frac{1}{150}$ of strychnia may be given every four hours. If collapse is imminent or present, ten to twenty drops of brandy may be given every two hours. If the brandy cannot be retained by mouth, it should be given hypodermically, especially in a case of emergency.

The fever should be reduced by friction baths. Often the skin is moist and cold in spite of a rectal temperature of 105° F. or over, and when this is so, vigorous friction must be used. A friction bath is given in the following manner: All the clothes are removed, and the infant is wrapped in a sheet. One part at a time is exposed and rubbed vigorously but gently until the blood is brought to the surface. Taking first an arm, the extremity is moistened with equal parts of alcohol and tepid water, and light friction continued until the water and alcohol are evaporated. This is repeated for five minutes, when the same treatment is given to the other arm, chest, abdomen, back, and legs. The evaporation of the water and alcohol cools the blood that is brought to the surface by the friction. A warm, full bath to dilate the capillaries in the skin may be given if the infant does not react to the friction bath. This bath should be given at a temperature of 105° F., and should last five minutes.

Morphine and atropin, used hypodermically in very small doses, will often stop the vomiting and diarrhœa quicker than anything else. It should not be used at the onset, nor until

the bowels have been evacuated thoroughly many times, nor while there is undigested food or fecal matter in the stools. Morphine is contra-indicated when there is stupor or much drowsiness and when there is no purging. The dose of morphine for a child one year of age is gr. $\frac{1}{64}$, given hypodermically. It should be combined with gr. $\frac{1}{600}$ of atropin. This may be repeated in one or two hours if the vomiting and diarrhœa are not improved.

Case XXXIV

(Illustrating the treatment of an infant exceedingly ill with a severe infectious diarrhœa)

July 21, 8 p.m.: Age, 4 months. Weight, 12 lb. 6 oz.

General Condition.—Well nourished, although the skin is a little wrinkled, due to recent rapid loss of fluids; eyes sunken, staring expression, fontanel depressed, body cold and moist; looks very sick.

Stools.—For twelve hours stools have been so numerous they could not be counted; rice-watery in character, composed almost entirely of serum and mucus.

Vomiting.—Almost continuous.

Appetite.—None.

Sleep.—Stupor.

Temperature, 105° F.

Chief Complaint.—Diarrhœa and vomiting.

Previous Food.—Breast-fed until one month ago, when artificial feeding was begun. This consisted of gradually-increased milk, water, and sugar mixtures, which agreed very well with the infant until a week ago, when a mild diarrhœa began. This lasted, untreated, until twelve hours before the patient was seen, when cholera infantum suddenly developed.

Treatment.—Washing out the stomach with plain water and irrigating the bowel with plain water. The stomach was to be washed once. The bowel was to be irrigated with two quarts of warm water. Grain $^1/_{200}$ of strychnia given subcutaneously every four hours. Twenty drops of brandy in water to be given every two hours if it is retained. A tub bath at a temperature of 105° F., followed by an alcohol friction bath every three hours if the patient's temperature is over 103° F. No food and *no* water allowed until the vomiting stops. Give one pint of sterile normal saline solution directly into the peritoneal cavity.

July 22, 9 a.m. (12 hours later):

General Condition.—Same as at last visit, except that stupor has disappeared.

Stools.—Not as numerous, but of the same character.

Vomiting.—Same as at last date.

Appetite.—None.

Sleep.—Restless.

Temperature, 106° F.

Treatment.—Grain 1/60 of morphine, to be repeated in one hour if vomiting has not improved. Brandy, 15 drops hypodermically, repeated if necessary. Eight ounces of sterile, normal saline solution given intravenously in the jugular vein; four ounces every four hours to be given subcutaneously, in a different place each time.

July 22, 6 P.M. (9 hours later):

General Condition.—No stupor; infant looks brighter.

Stools.—Three or four since last visit, composed of mucus and serum.

Vomiting.—Stopped one hour after morphine was given.

Appetite.—Nothing offered.

Sleep.—A little.

Treatment.—One ounce of a 10 per cent. glucose solution by mouth every half hour, to be gradually increased in quantity, one-half ounce at a time. Later, if well retained, to be given *ad libitum*. Strychnia continued; brandy, 15 drops every two hours by mouth.

July 23 (15 hours later):

General Condition.—Much improved.

Stools.—Five since last visit; about the same character.

Vomiting.—None.

Appetite.—Taking a large amount of glucose solution well.

Sleep.—Some.

Temperature, 102° F.

Treatment.—Food prescribed:

Malted Milk ..	1 level teaspoonful	Feed 2 oz. (gradually increasing to 4 oz.) every 2 hours.
Water	2 oz.	

Brandy discontinued; strychnia, gr. 1/200 every 6 hours.

July 24 (1 day later):

General Condition.—As at last date.

Stools.—Four brown, watery, with mucus.

Vomiting.—None.

Appetite.—Hungry; takes 4 ounces every 2 hours.

Sleep.—Fair.

Temperature, 100° F.

Treatment.—Food prescribed:

Malted Milk ..	2 level teaspoonfuls	Feed 4 oz. every 2 hours. Strychnia continued.
Water	4 oz.	

After three days of an exclusive malted milk diet, one-third milk and two-thirds water, boiled, was used instead of water and the malted milk added to it (four ounces every two hours), and the baby went on to an uninterrupted recovery.

Dehydration (Anhydremia).—During the course of any severe diarrhœa or uncontrollable vomiting, as illustrated in the last case, a condition develops called dehydration, due to the excessive loss of body-fluids, and the characteristic symptoms of concentration of the blood develops. The causes of this loss of fluids are the frequent copious watery stools, vomiting and the consequent inability to retain fluids given by mouth, the excessive loss of fluids in the form of perspiration, especially during the hot weather, and the moisture in the expired air. In addition to this, the osmotic balance within the body tissues is disturbed and the tissues have a temporary inability to retain water, especially when salts and sugars are not administered. It is now known that the resulting serious symptoms are due to loss of water, rather than to the absorption of toxic material or alimentary intoxication, as was formerly thought. Dehydration may be seen in pneumonia or other severe acute infections, in young breast-fed infants who are nursing dry breasts, or in pyloric stenosis when no fluids pass through the pylorus.

The first symptoms are usually an extremely rapid loss of body weight, as much as a pound in twenty-four hours. As soon as this takes place, the typical picture of dehydration appears. The lusterless and film-covered eyes become sunken and staring, or are turned up under the half-closed lids. A grayish pallor denotes arterial constriction, the result of the diminished blood volume, and the skin is dry and wrinkled and inelastic, so that when it is picked up in the fingers it does not immediately go back into place, but stays wrinkled. Infants who have a fat layer, have a peculiar doughy feel to the skin, almost like the dead body. The respirations become deep and labored, and the accessory respiratory muscles are set to

work, as a result of air hunger, just as in diabetic coma or acidosis from any cause, although the condition may be unaccompanied by acidosis. The urine is scanty and may contain albumin and casts. The temperature is high, whether any acute infection is present or not, on account of the disturbed circulation in the heat centres. At first there is extreme restlessness, turning the head from side to side, later partial coma with an irritable whine and finally collapse with complete coma, convulsions and often death, especially if the dehydration is accompanied by acidosis.

Most of these cases, if seen early, can be cured and are often on the road to recovery over night. The author has seen infants with respirations as low as 4 per minute, in total coma, who, within twelve hours after the administration of fluids into the peritoneal cavity, were revived and almost happy and smiling. The urgent need is water, which may be given by five different routes: by mouth, by rectum, under the skin, into the peritoneal cavity and into the veins. If there is no vomiting and the infant can swallow, a constant flow of water should be kept going down the throat. Do not order water *ad libertum,* but set a goal of a definite number of ounces each hour, night and day. Often water is retained when given with the stomach tube even though it is vomited when fed. The usefulness of rectal installations are very much exaggerated, for although worthy of trial they are usually poorly retained and only soil the bed and make the patient uncomfortable. Fairly large amounts of normal saline or glucose solutions may be given under the skin by hypodermaclysis, as many as eight to twelve ounces at a time, into the loose tissue of the back or under the breasts. It must be given at

body temperature, slowly and two or more needles may be attached to the same rubber tubing, and as in intraperitoneal injections, the most careful asceptic precaution must be maintained and the fluids should be allowed to flow in by gravity. The easiest and safest method of administering water is the peritoneal route when it cannot be retained by mouth. Puncturing the intestines has never occurred in our experience, nor have we ever seen peritonitis developed. A nineteen gauge needle is attached by means of a long rubber tube to the gravity jar, containing a pint of sterile normal saline solution. The skin over the entire abdomen is painted with iodine; with sterile gloves, the skin is grasped just below the umbilicus and pointing the needle upward (toward the head) it is inserted slanting, half-way between the pubes and the umbilicus. The solution may be allowed to flow in until the abdomen is moderately distended, often a pint may be given in this way, which is absorbed in one to three hours. Ringer's solution may be used instead of the normal saline, but glucose solutions have been known to cause a sterile peritonitis. The injections may be repeated every four or five hours. Intravenous injections are difficult to give to small infants, except in the most skilled hands of those accustomed to getting into the infant's veins. There is no question, however, that this method of administering fluid is extremely effective if it can be accomplished. The rapidity with which the patient revives in certain cases is nothing short of miraculous. It should not be forgotten that infants suffering with other acute infections, outside of those of the gastro-intestinal tract, are occasionally much benefited by the treatment.

Diarrhœa of long standing, sometimes called chronic diar-

rhœa, is effectively treated with a carbohydrate diet combined with fat-free milk. Every year a large number of infants are seen whose stools have been loose during the whole summer and who have become emaciated, anæmic and even rhachitic from the inability to digest their food. Not only does the pure carbohydrate and the fat-free diet stop the diarrhœa but it makes it possible to put on weight with remarkable rapidity.

Case XXXV

(Illustrating thick gruel diet in infants old enough to eat from a spoon)

January 3: Age, 7 months. Weight, 15 lb. 8 oz.

General Condition.—Pale, emaciated, ribs all showing (size of six-months-old baby), delicate facies, considerable abdominal distention.

Stools.—For three months, two to five loose, watery, yellow stools a day with much mucus and often considerable tenesmus.

Vomiting.—None.

Appetite.—Ravenously hungry all the time.

Sleep.—Good.

Temperature, 98.6° F.

Chief Complaint.—Diarrhœa, emaciation.

Previous Food:

Milk (unboiled)	4 oz.
Barley	8 oz.
Sugar	none

Cereal was given once a day; meat broth, spaghetti and bread once a day. Four bottles of the formula were given a day, at intervals of three hours.

Treatment.—Food prescribed:

6 A.M.—Eight ounces of barley gruel made of half fat-free milk.

10 A.M.—Imperial Granum, cornstarch or browned flour gruel made thick enough to eat with a spoon and made with half fat-free milk; Arrowroot crackers, zweiback or Uneeda biscuits.

2 P.M.—Same as at 10 A.M.

6 P.M.—Bread pap; barley gruel made with fat-free milk, thin enough to drink from a cup; Arrowroot crackers.

10 P.M.—Same as at 6 A.M.

January 7 (4 days later): Weight, 16 lb. 8 oz.
Gain, 1 lb.

General Condition.—Slightly improved.

Stools.—Two normal, firm stools a day.

Vomiting.—None.

Appetite.—Hungry; has taken very large quantities of gruel, often to fifteen ounces at a feeding.
Sleep.—Good.

Treatment.—Food prescribed:

Same as at last date, except that four ounces of fat-free milk, which has been boiled three minutes, is given from a cup at each meal, in addition to the above prescribed food or in place of the thin barley gruel.

January 15 (7 days later): Weight, 17 lb. 6 oz.
Gain, 14 oz.

General Condition.—Much improved.
Stools.—Three firm, normal stools.
Vomiting.—None.
Appetite.—Excellent, still takes large quantities of food.
Sleep.—Good.

Treatment.—Food prescribed:

Same as at last date, except that a total of one and one-half quarts of fat-free milk is allowed each day, including that in which the gruels are cooked.

January 22 (7 days later): Weight, 18 lb. 6 oz.
Gain, 1 lb.

General Condition.—Improved.
Stools.—Still normal.
Vomiting.—None.
Appetite.—Excellent.
Sleep.—Good.

On February 20th this baby weighed twenty-one pounds eight ounces, gaining six pounds in about six weeks. There was no return of diarrhœa when baked potato and vegetables were added for their minerals as well as for their nutritive value.

CHAPTER XII

ACIDOSIS ACCOMPANYING INTESTINAL INTOXICATION

It not infrequently happens that in the course of a gastro-intestinal disturbance in infancy toxic symptoms develop, which appear to be the direct cause of death. Most commonly the onset of the toxæmia is gradual, though in some instances it is sudden. Nearly always there is a preliminary period of diarrhœa, which may be of almost any grade of severity, though it does occasionally happen that the infant is constipated at the time of the onset of the symptoms. It is not to be taken for granted that a toxæmia occurring as a part of the picture of a gastro-enteritis necessarily means that the infant is suffering from an acidosis. It is a common misconception to regard acidosis as a cause or as of itself a disease entity, when in reality it is nothing more than a symptom complex, and a diagnosis which contents itself with a mere label of acidosis is about as conclusive in the long run as the claim that the patient is suffering from a fever. Many acute and chronic diseases present at some time during their course a moderate degree of acidosis and the mechanism in all instances is similar, though the essential cause is nearly as variable as the diseases themselves. As a matter of fact, acidosis is a superimposed condition, which may of itself threaten life, but which in no way serves as an explanation of disease. In the toxæmias of gastro-intestinal origin occurring in infants the true etiological factors are toxic agents, which are probably of bacterial origin.

An acidosis is perhaps best defined as a reduction of the sodium bicarbonate of the blood below the normal level.

The clinical and laboratory evidences of the presence of an acidosis may be briefly summarized as follows:

(1) Hyperpnœa.

(2) Increased tolerance for sodium bicarbonate.

(3) Acetone odor of the breath and acetone and diacetic acid found in the urine.

(4) Stupor or coma.

(5) Diminished urinary excretion.

(6) Improvement under alkali treatment.

(7) Special examinations:

(*a*) Alveolar air.

(*b*) Blood plasma.

(*c*) Ammonia coefficient of the urine.

(1) Clinically, acidosis is evidenced by more rapid and deeper breathing (increased pulmonary ventilation or hyperpnœa), and if this sign is unaccompanied by cyanosis it is almost diagnostic.

(2) The determination of the tolerance for sodium bicarbonate is so easily made as to be fairly considered a clinical evidence of acidosis. According to Schloss and Stetson, a single maximum dose by mouth of sodium bicarbonate of forty-five grains is sufficient to render the urine of normal infants and small children alkaline. In acidosis, five times this amount may be required to change the reaction of the urine.

(3) In a certain number of cases of acidosis there is a characteristic odor of acetone on the breath and varying amounts of acetone and diacetic acid are present in the urine. These substances are not present in amounts proportional to the severity of the symptoms nor to the degree that the carbon dioxide tension of the blood is reduced. It should be added that in a certain number of severe cases of acidosis these bodies may be entirely absent and that the presence of small amounts of these bodies must be considered as having no significance.

(4) Stupor or even coma often accompanies an acidosis, though in our opinion it is a toxic manifestation rather than a consequence of acidosis. In any event, quite a severe grade of acidosis is not infrequently met with in which there is little or no stupor.

(5) The excretion of the urine in the acute stages of acidosis is greatly diminished and often at this time contains albumin and casts.

(6) In true cases of acidosis there is an improvement of the symptoms, especially of the hyperpnœa, after the correction of the acidosis by alkali.

(7) In a certain number of cases the diagnosis of acidosis will necessarily be dependent upon special determinations, such as: (*a*) the decrease in the carbon dioxide of the blood and the alveolar air; (*b*) the decreased carbon dioxide combining power of the blood plasma; and (*c*) a high ammonia coefficient of the urine. A positive finding in any one of this group of special determinations along with a diarrhœa in which symptoms of intoxication and hyperpnœa have developed will make the presence of acidosis a certainty.[1]

There is nothing in the animal economy that remains more constant than the reaction of the blood. Considerable additions of alkali or acids may be made to the blood without much change in the reaction. This is due to the property that weak acids like carbonic and phosphoric acids have of not changing their reaction in the presence of a solution which contains an excess of their salts.

The acids and alkalies in the blood are in part derived from the food and in part from their constant production in the processes of metabolism. The removal of the acids from the body is effected in three ways: (1) gaseous carbonic acid is eliminated through the lungs; (2) the fixed acids are ex-

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[1] For methods of making these special determinations see text-book "Physiology and Biochemistry in Modern Medicine," by Macleod.

creted through the kidneys; and (3) phosphoric acid is to a certain extent excreted through the intestines. A considerable damage to any of these organs establishes a tendency to a faulty elimination or, in other words, a retention of acids. A large depletion of the body fluids may have the same effect in that there is a deficient secretion of urine (Schloss). As acids are added to the blood they will at first be neutralized by the "buffer" substances of the plasma —namely, sodium bicarbonate and the proteins, later by "buffer" substances in the corpuscles and perhaps by other cells in the body. As the acid concentration of the blood (H ion concentration) increases, there will be, in addition to their neutralization by the "buffer" substances, an increase in the efforts to eliminate them through the normal channels of excretion. For instance, the amount of carbonic acid present in the blood progressively diminishes as other acids increase in amounts, this result being accomplished by an increase in the depth and rapidity of respiration rate, *i.e.*, there is an increase in the pulmonary ventilation. It thus comes about that a reaction of the carbon dioxide content of the blood signifies a diminution of the fixed alkali of the blood and is therefore an important evidence of the actual establishment of a condition of acidosis.

Acidosis plays a rôle in the symptomatology of many diseases of childhood, among which may be mentioned:

1. Cyclic vomiting.
2. Starvation.
3. Post-anæsthesia.
4. Diabetes.
5. Uræmia.
6. Intestinal toxæmia.

There is no pretense that this is a complete list of the considerations which may be accompanied by acidosis, but it does serve to indicate that acidosis is not of itself an essential causal agent of disease. The mechanism of an

acidosis is always similar, though the means by which the condition is brought about may show great variation. In a diabetes, for instance, acidosis may result from a perversion of the normal metabolic processes, while in uræmia the underlying cause is found in the inability of the kidney to excrete waste products in a normal fashion. In the intestinal toxæmia the etiological causes are toxic agents either of proteid or bacterial origin. There is a considerable group of anaërobes that are commonly found in the gastro-intestinal tract that are capable of elaborating powerful toxins that have not only a hæmolytic (commonly) action, but that are also capable of producing a widespread cloudy or fatty degeneration of parenchymatous epithelium. If these toxins are absorbed into the general circulation in sufficient quantities they may cause death within a few hours with many or all the symptoms commonly ascribed to acidosis.

Treatment.—The treatment of acidosis has, in a general way, two main purposes to accomplish. First, it is necessary to remove the source from which the toxic agents are derived in order to prevent, as far as possible, the continued elaboration of toxic agents. The second aim is to return the blood to its normal reaction by an increase in elimination and by direct neutralization.

As the toxin in this instance is elaborated in the gastro-intestinal tract, it is necessary to clean out the entire tract in the shortest possible length of time. This is accomplished by a thorough and painstaking washing of the stomach and large intestines. A single change of water is not sufficient. The stomach is to be siphoned out until the returned water is absolutely clear, which in many instances will require five or six changes of water. As a rule, plain water is not used, but a 5 per cent. solution of sodium bicarbonate. The stomach is finally emptied and half an ounce of castor oil is run

through the tube and left in the stomach. The large intestine is washed in the same careful manner. Every effort is made to reach the cæcum by elevating the hips and turning the child from the left to the right side. The water is run into the intestine slowly and should enter the rectum at a temperature of 102° F. When the large intestine is filled, it should be drained off and the operation is repeated. Not less than a quart of water is used for each washing, and it should be repeated until the return is approximately clear. Here again a 5 per cent. sodium bicarbonate solution is preferred to plain water. Eight or ten ounces of the sodium bicarbonate solution is left in the large intestine. It will often be necessary to repeat the washing of the stomach and the intestines at the end of six or eight hours. If the castor oil is vomited, it will probably be necessary to wash the stomach and large intestines at shorter intervals, and the castor oil, under these circumstances, should be repeated at least once. Calomel is too slow in its action to be an ideal cathartic for these cases, while magnesium sulphate tends to further deplete an already depleted body of its fluids.

An increase in the elimination is also promoted by replacing the lost fluids of the body tissues. This may be accomplished by direct injection of physiological salt solution into a vein, by subcutaneous injections or by intraperitoneal injections of salt solution. The subcutaneous injection of physiological salt solution is a familiar method. The chief objection to its use in these cases is the slowness of the absorption, so that the amount which will enter the circulation in a given length of time is limited. Intraperitoneal injections of saline are not dangerous, may be repeated as often as necessary, are easily done, and allow of the absorption of large amounts of fluid in a minimum time. The patient lies on its back with arms and legs restrained in a sheet or jacket. The needle is inserted through the linea alba just below the umbilicus, its point being directed

upward and the needle at an oblique angle. The skin and subcutaneous tissues are picked up between the thumb and index finger and pulled outward while the needle is being inserted. The fluid is allowed to run into the peritoneal cavity by gravity until the abdomen becomes slightly distended. The fluid should not be introduced too rapidly in order to avoid the possibility of embarrassing the respiration and circulation. Three to five hundred cubic centimetres, depending on the size of the child, can be introduced in from fifteen to twenty minutes. The temperature of the solution when it enters the peritoneal cavity should be about 100° F. The solution is a physiological salt solution (0.8 per cent. sodium chloride). A solution containing sodium bicarbonate would probably be dangerous, owing to its chances of containing at least a small amount of sodium carbonate.

Diet forms a very important part of the treatment of acidosis. During the first twelve or twenty-four hours there should be starvation. It is to be remembered that the complete withdrawal of carbohydrates tends of itself to bring about a condition of acidosis. For this reason, the first foods that are allowed are the carbohydrates, preferably in the form of glucose or starches. Cereals gruels, such as cream of wheat, rice and barley, are to be used. They must be thoroughly cooked (four hours in most instances). At first they are to be given in small quantities at three- of four-hour intervals and the amount rapidly increased. They should not be too thin, having a consistency that will barely pour. It will often be necessary to refrain from giving milk for a number of days, for the most common mistake in the treatment of cases of acidosis is a too early return to a partial or full milk diet. When the return to a milk diet is made, it should be gradual.

CHAPTER XIII

SENSITIZATION TO COW'S MILK

SENSITIZATION to the protein of cow's milk, is brought about in the following manner. A small infant, usually during the course of some gastro-intestinal disturbance, is fed cow's milk or whey mixture for the first time. This foreign protein is absorbed directly into the infant's circulation without having been properly digested or changed into the amino acids which the infant can utilize. The tissues are then rendered so sensitive that when at any subsequent time cow's milk is given again, a more or less severe anaphylactic shock is brought about. This same phenomena occurs with many different proteins, for we are all familiar with those individuals who are "poisoned" by shellfish, veal, eggs, cherries, or what-not.

The following example of cow's milk anaphylaxis recently seen, was very striking. A baby of four months, who had always been breast fed, had not gained in weight for the past two weeks and seemed very hungry in spite of the fact that the mother's diet and the infant's routine had been carefully regulated. It was evident that the breast-milk supply was not sufficient to properly nourish the infant, so a formula of one-third cow's milk and two-thirds water was ordered. The mother returned home, made up the formula immediately and had given only an ounce of it when violent vomiting began and the baby's mouth and lips and face began to swell, the breathing became labored, cyanosis developed and it seemed as though the babe were going to die. She reported the con-

dition by telephone and was told to give a tablespoonful of castor oil, plenty of water and no food until morning. Emphasis was laid upon the instructions never to give that babe cow's milk again. The infant revived and was entirely well the next morning when breast milk was resumed. Before coming for further instructions she went to a distant city where another physician noting the infant's need of food, again ordered cow's milk mixture with a repetition of the same experience. Still later another physician tried dried milk, which acted exactly as did the fresh milk.

Severe milk anaphylaxis of this sort is not common, the author having seen in his entire experience of many years only eight or ten examples. On the other hand, mild types are not uncommon, for it is not at all unusual to see children who have asthma or urticaria or eczema or other allergic manifestations. Sensitization to egg protein is met with many times a year, again in its less severe form. It is possible to cure an infant of this idiosyncrasy by a process called desensitization, which consists of administering the offending protein in minute but gradually increasing doses given over a long period of time until large quantities give no symptoms. This may be done hypodermically, but the easiest method is to put five drops of milk into a saucepan of cereal when cooking, thus diluting the milk many times. This dilution is given for a week and then ten drops are used, and so increasing gradually for several months, till large quantities are ingested without causing milk anaphylaxis.

Goat's milk is useful and almost indispensible for infants that have acquired anaphylaxis to cow's milk and it may be used in place of cow's milk wherever it is available and cow's milk is not. It is said by some authorities to be more easily digested, that is, that the casein does not

form as hard curds in the infant's stomach as does cow's milk. Whether this is true or not, certain infants seem to thrive upon it, who have not done so with cow's milk. However, cow's milk is available either in the dry or fresh state in almost every part of the world, and it would not seem as though goat's milk would ever be as widely used as some enthusiasts believe. Its chief usefulness in our hands is for infants who have acquired an idiosyncrasy or anaphylaxis for cow's milk. Goats are also said to be immune to tuberculosis, which would be a decided advantage. They are easy to raise, live on food that other animals will not eat, and seem to be all-around comfortable creatures. Canned evaporated, unsweetened goat's milk can now be obtained in most cities, (Widemann Goat Milk Co., San Francisco, California).

The following statements and analyses are taken from the University of California Bulletin 285, pages 93 and 94. The composition of goat's milk varies as that of cow's milk, with the breed, period of lactation, and the individuality of the animal. But little information is at hand concerning the composition of the milk of goats of different breeds. A few analyses of goat's milk taken from the different sources are given below.

Composition of goat's milk (Geneva, N. Y., Agricultural Experiment Station).

Analyses were made of twenty-three samples of milk from eleven animals:

	Average per cent.	Variations per cent.
Fat	3.82	1.80– 8.40
Total solids	12.12	9.22–17.63
Total proteins	3.21	2.24– 5.21
Casein	2.40	1.56– 4.06
Ash	.55	.40– .80

Specific gravity, 1.0294.

In the Bureau of Animal Industry Farmer's Bulletin No. 920, on milk goats, the following analyses of goat and cow milk are given:

	Goat Milk per cent.	Cow Milk per cent.
Fat	5.99	3.9
Solids not fats	10.97	9.0
Total solids	16.96	12.9
Sugar	4.93	5.1
Protein	4.63	
Water	83.04	87.1

Specific gravity, 1.0338.

CHAPTER XIII

CONSTIPATION IN BOTTLE-FED INFANTS

By constipation is meant a sluggish action of the bowels, giving rise to stools that are less frequent and harder and drier than normal. Constipation does not necessarily mean a retention of the fæces.

The physician should never take the report of a mother or nurse as to the consistency, moisture, and number of the stools, but should personally examine them. A mother will frequently tell you that her baby is constipated when the stools are merely harder or less frequent than usual. Strong mixtures of milk and water produce stools that are of a firmer consistency than those occurring in infants taking breast milk and some other foods. So long as a stool is not actually dry or crumbly it cannot be called constipated. A stool, too, may be normal in consistency when the infant has become habituated to cathartics, enemas, or suppositories, and therefore evacuation of the bowels is not voluntary.

The normal number of stools varies with the infant and with the food given. One a day is sufficient at any age, but for younger infants two are preferable. All mothers, and many physicians, look upon constipation as a much more serious condition than it actually is. Persistent constipation throughout the bottle period will not, in itself, cause any nutritional disturbances. As a matter of fact, an infant may gain progressively in weight and do well in every other respect where constipation exists. Constipation following a diarrhœa is always welcome, because it indicates that the sugar and the various other elements of the food may be increased without doing any harm. This fact should be explained to the mother, lest she worry about the consti-

pation and perhaps give a cathartic without being instructed to do so, thus causing a recurrence of the diarrhœa.

The causes of constipation in bottle-fed infants are many and varied. Most of them have to do originally with the food, the abuse of cathartics usually serving to increase the difficulty. The cases that are the most resistant to treatment are those that have received cathartics of various sorts over a long period of time. With such cases it is never advisable to give cathartics until all possible dietetic measures have failed.

CAUSES OF CONSTIPATION IN THE BOTTLE-FED

(1) Gastric indigestion
(2) Too much fat
(3) Too much sugar
(4) Too little sugar
(5) Too little or too weak food leaving little residue.
(6) Too concentrated food
(7) Excessive vomiting or lack of appetite
(8) Boiled milk
(9) Cathartics
(10) Habit
(11) Organic lesions: Fissure anus; abnormally small anus; hemorrhoid; polypus

(1) **Gastric Indigestion.**—Any food which causes gastric indigestion may cause either diarrhœa or constipation. Some bottle-fed infants have a tendency to diarrhœa, and whenever there is a dietetic error of any sort their bowels become loose at once. Others have a tendency to constipation, and gastric indigestion causes the bowels to become sluggish in their action. Dietetic errors have been fully discussed under "Diarrhœa," "Vomiting," and "Loss of Appetite."

Treatment.—Constipation due to gastric indigestion must have treatment appropriate for the causative factor.

(2) **Too Much Fat.**—The practice of increasing the fat to overcome constipation is no longer popular. If the food is deficient in fat, increasing it slightly will have a beneficial action upon the bowels, but if the fat is already sufficient in quantity and there is constipation, increasing

it may only serve to make the constipation worse. The author saw far more constipation in bottle-fed infants when he was using top milks than he has seen with whole-milk mixtures properly used. Fat constipation is seldom caused by whole milk properly diluted, and for this reason those who do not use creams or top milks will not often have this difficulty to deal with.

Fat constipation is brought about by the fats splitting into fatty acids in the intestines. The alkalies, secreted by the intestinal mucosa, unite with these fatty acids and form insoluble soaps. Such a condition of affairs gives rise to hard, dry stools that are white or gray in color and often crumbly in appearance, sometimes resembling sand. If this condition is allowed to continue, mucus may appear and the stools become green in color, or, finally, diarrhœa may follow.

Treatment.—An infant that has fat indigestion from cream or top-milk mixtures, therefore, should have this excessive fat diminished by feeding whole milk, water, and sugar in the proper quantity.

Case XXXVI

(Illustrating the use of whole milk, water, and sugar to relieve constipation from excessive fat)

May 19: Age, 5 months 2 weeks: Present weight, 11 lb. 10 oz.
Birth weight, 4 lb. 8 oz.

General Condition.—Poorly nourished, color fair, good musculature, no bony deformities. Needs from 50 to 55 calories per pound per day.

Stools.—Has been constipated for about a month, having one hard stool a day, either with the aid of an enema or suppository.

Vomiting.—None.

Appetite.—Good; takes all the food.

Sleep.—Good during the day, poor at night.

Temperature, 98.6° F.

Chief Complaint.—Constipation.

Previous Food.—Top-milk mixtures since birth. A month ago increased in strength to:

9 oz. top milk (12 per cent. fat)	15 oz.	unboiled	Fed 4+ oz. every 3 hours, 7 feedings in 24 hours.
Water	15 oz.	unboiled	
Milk sugar	1½ oz.		

Treatment.—Food prescribed:

Whole milk.......	20 oz.	unboiled	400 cals.	Divide into 7 feedings. Feed 6– oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water............	20 oz.	unboiled		
Dextri-maltose....	1 oz.		120 cals.	

520 cals., or 44+ cals. per pound.

May 26 (7 days later): Weight, 11 lb. 13 oz.
Gain, 3 oz.

General Condition.—The same.
Stools.—One a day, softer than formerly, with a small enema each day.
Vomiting.—None.
Appetite.—Good.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	21 oz.	420 cals.	Divide into 7 bottles. Feed 6 oz. every 3 hours as before.
Water...........	21 oz.		
Dextri-maltose ...	1½ oz.	180 cals.	

600 cals., or 50+ calories per pound.

June 2 (7 days later): Weight, 12 lb. 6 oz.
Gain, 9 oz.

General Condition.—Improved.
Stools.—One normal each day without enema.
Vomiting.—None.
Appetite.—Good; takes all the food.
Sleep.—Excellent.
Treatment.—Food unchanged.

(3) Too much sugar is the cause of constipation only when the sugar is increased far beyond the limit of the infant's capacity. During our early studies with sugar, when it was considered a laxative under all circumstances, large amounts were used in an attempt to overcome stubborn constipation. This was seldom helpful. Occasionally an infant who was getting one and a half ounces of sugar in the twenty-four-hour amount would be benefited by increasing the sugar to two ounces in the twenty-four-hour amount, but this was not universally true. On the other hand, many constipated infants whose sugar was increased to more than

two ounces in twenty-four hours were made more constipated by the treatment.

Treatment.—In constipated infants whose twenty-four-hour quantity of food contains two ounces of sugar, or even one and a half ounces, this condition may be remedied by cutting down the sugar to one ounce in the twenty-four-hour amount when the deficiency in the sugar is made up by adding more milk to the food.

The normal amount of sugar for an infant under ten pounds of weight is one ounce in the twenty-four-hour amount. Infants weighing more than ten pounds may have one and one-half ounces in the twenty-four-hour amount. When the food is correct in every other way, it is rarely necessary to give more than one and one-half ounces of sugar, and two ounces is the maximum quantity that should ever be used for any bottle-fed infant.

As to the kinds of sugar which are best used to overcome constipation, malt soup extract seems to act most favorably in infants who are stubbornly constipated, probably because of the potassium carbonate which it contains. Malt sugar itself (dextrin and maltose) does not seem to have this action unless potassium carbonate is added to it. The author has never been convinced that malt sugar was more laxative than cane sugar, or milk sugar, nor that the reverse was true. Mead's Dextrimaltose No. 3 contains potassium carbonate instead of common salt (sodium chloride) which is in the No. 1. Constipation is often immediately overcome by changing from No. 1 to No. 3.

Case XXXVII

(Illustrating a case of constipation from too much sugar)

April 10: Age, 4 months. Present weight, 12 lb. 9 oz.
Birth weight, 7 lb.

General Condition.—Normal, fat, well-nourished infant. Needs from 45 to 50 calories per pound per day.

Stools.—One, constipated, a day with the aid of a soap suppository. Movements sometimes so hard that a streak of blood could be seen on the outside of the stool.

Vomiting.—A little, three or four times a day.
Appetite.—Seems hungry.
Sleep.—Fair; cries a good deal from colic.
Chief Complaint.—Constipation.

Previous Food:

Milk	18 oz.	unboiled	360 cals.	Fed 5 oz. every 3 hours, 7 feedings in 24 hours.
Water	18 oz.	unboiled		
Cane sugar..	2½ oz.		300 cals.	

660 calories, or 53– calories per pound.

Treatment.—Food prescribed:

Milk	21 oz.	unboiled	420 cals.	Divide into 6 feedings. Feed 6 oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M.
Water	21 oz.	unboiled		
Cane sugar....	1 oz.		120 cals.	

540 cals., or 43+ calories per pound.

April 17 (1 week later): Weight, 12 lb. 12 oz.
Gain, 3 oz.

General Condition.—The same.
Stools.—One voluntary a day, still somewhat hard.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.

Treatment.—Food prescribed: Gradually increase to:

Milk	24 oz.	unboiled	480 cals.	Divide into 7 bottles. Feed 6 oz. every 3 hours as before.
Water	20 oz.	unboiled		
Cane sugar.	1½ oz.		180 cals.	

660 calories, or 52 calories per pound.

This infant continued to improve and the stools were normal and voluntary thereafter.

(4) **Too Little Sugar.**—It may seem paradoxical to say that too little sugar in the food may cause constipation and that too much sugar will cause the same condition. That too little sugar causes constipation has been demonstrated over and over again by increasing the sugar in an infant's food that is deficient in sugar. Infants who have constipation following diarrhœa and whose sugar has been stopped on account of the diarrhœa will have normal voluntary movements when the sugar is properly increased. After a diarrhœa the constipation brought about by stopping the sugar is desirable, and it is important that the sugar be *gradually*

increased for fear of a recurrence of the diarrhœa. Under these conditions there is absolutely no doubt that sugar acts as a laxative.

Treatment.—The treatment of constipation due to too little sugar consists in gradually increasing the amount of sugar in the food up to one ounce for the infant under ten pounds in weight and one and a half ounces for an infant over this weight. Occasionally the older, larger infant may receive two ounces in the twenty-four-hour amount and the constipation be benefited thereby.

Case XXXVIII

(Illustrating a case of constipation from too little sugar)

September 15: 7 months: Present weight, 14 lb. 2 oz.
Birth weight, 5 lb. 6 oz.

General Condition.—Small, but fat, well nourished, good color and good musculature, no bony deformities. Needs from 40 to 45 calories per pound per day.
Stools.—Since recovering from an attack of diarrhœa a month ago has been constipated, *having only one hard movement a day, and that with a sweet-oil or water enema.*
Vomiting.—None.
Appetite.—Satisfied.
Sleep.—Good.
Temperature, 98.6° F.
Chief Complaint.—Constipation.

Previous Food:

Milk	24 oz.	boiled	480 cals.	Fed 8 oz. every 3 hours, 6 feedings in 24 hours.
Water	24 oz.	boiled		
Dextri-maltose..	¾ oz.		90 cals.	
			570 calories, or 40+ calories per pound.	

Treatment.—Food prescribed:

Milk	24 oz.	boiled	480 cals.	Divide into 6 feedings. Feed 8 oz. every 3 hours, at 6, 9, 12 A.M., 3, 6, 9 P.M.
Water	24 oz.	boiled		
Dextri-maltose..	1 oz.		150 cals.	
(In 3 days increase sugar to 1¼ oz.)			630 calories, or 45– calories per pound.	

September 21 (6 days later): Weight, 14 lb. 9 oz.
Gain, 7 oz.

General Condition.—The same.
Stools.—One voluntary, still somewhat hard.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	28 oz.	boiled	560 cals.	Divide into 6 feedings. Feed 8 oz. every 3 hours as before.
Water	20 oz.	boiled		
Dextri-maltose .	1½ oz.		180 cals.	
			740 calories, or 51 calories per pound.	

Within the next few days there was *one normal, voluntary stool a day, soft and smooth.*

The reason the milk was given boiled was because this particular infant had had diarrhœa two or three times during its life when raw milk was given, and raw milk given even for a day would cause two or three loose stools containing hard curds.

(5) **Too Little or Too Weak Food Having Little Residue.**—Too weak food acts in two ways in causing constipation: First, it does not leave enough residue in the intestinal canal to form a stool sufficient in size to be evacuated once in twenty-four hours; and, second, an atonic condition of the bowels is brought about by the underfeeding. It may easily be seen that if the muscles and other organs of the body atrophy and the infant is feeble, the same condition may be found in the muscles of the intestinal wall and thus cause constipation. The lack of residue may be due not only to underfeeding with various weak mixtures of milk, top milk or cream, but to certain proprietary foods, malted milk, and foods which are made up of starches or sugars and used without milk. If there is not enough material in the intestinal canal to form a good-sized movement each day, the proper peristaltic action of the bowel will not be excited. Infants underfed in this way are ill-nourished and emaciated,

and many of them have vomiting and loss of appetite as well as constipation.

Treatment.—Constipation is not the most urgent symptom to be treated in infants thus underfed, but the treatment for the constipation also improves the infant's nutrition and digestive disturbances. If too weak dilutions of milk and water are being used, the strength should be increased. If malted milk or any of the proprietary foods without milk are being used, they should be stopped at once and weak dilutions of milk begun, usually one-third milk and two-thirds water. If no sugar has been given in the previous food, the sugar should be added, one teaspoonful at a time. If the food previously given has contained the proper amount of sugar, it does no harm to start with the same amount of sugar in the new food, or an increased amount, provided there is no vomiting or lack of appetite.

Case XXXIX

(Illustrating a case of constipation from too weak a food)

July 5: Age, 4 months. Present weight, 9 lb. 8 oz.
Birth weight, 7 lb.

General Condition.—Poorly nourished, pale, poor musculature; no evidence of rickets. Cries vigorously. Needs 55 calories per pound per day.

Stools.—For two weeks, *one a day, a teaspoonful of milk of magnesia being given at night. No movement without this.*

Vomiting.—None.

Appetite.—Hungry.

Sleep.—Poor, both night and day.

Temperature, 98.6° F.

Chief Complaints.—Constipation, crying, not gaining in weight.

Previous Food.—This infant was artificially fed during the first two months of its life. Then had a wet nurse for one month, during which time very good progress was made. For the last month has had:

Milk	15 oz.	boiled	300 cals.	Fed 4+ oz. every 3 hours, 7 feedings in 24 hours.
Water........	15 oz.			
Cane sugar ...	½ oz.		60 cals.	

360 calories, or 38– calories per pound.

Treatment.—Stop milk of magnesia; give water enema if bowels have not moved within 36 hours.

Food prescribed:

Milk	20 oz.	boiled	400 cals.	Divide into 7 feedings. Feed 6-oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water	20 oz.	boiled		
Cane sugar......	1 oz.		120 cals.	
			520 calories, or 55− calories per pound.	

July 8 (3 days later): Weight, 9 lb. 12 oz.
Gain, 4 oz.

General Condition.—Unchanged.
Stools.—*One normal, soft, smooth stool a day without milk of magnesia or enema.*
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.
Treatment.—Food unchanged.

July 29 (3 weeks later): Weight, 10 lb. 12 oz.
Gain, 1 lb.
(Has only gained 3 oz. in last week.)

General Condition.—Much improved.
Stools.—For the last week, one hard stool a day. Seldom has to use enema.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.

With the increase in weight, the food not being increased, the infant had been getting less than fifty calories per pound. This was the cause of the constipation and insufficient gain during the last week. The food should have been increased a week earlier but the patient lived at a distance and was unable to bring the baby to the office sooner.

Treatment.—Food prescribed:

Milk	22 oz.	boiled	440 cals.	Divide into 7 bottles. Feed 6 oz. every 3 hours as before.
Water	20 oz.	boiled		
Cane sugar ...	1½ oz.		180 cals.	
			620 calories, or 58 calories per pound.	

This brought the calories up to the required number per pound. The bowels remained normal with a gradual increase in the food to meet the caloric needs, as the infant's weight increased.

(6) Too Concentrated Food.—Strong dilutions occasionally cause constipation. Some years ago when the simple dilutions of whole milk were first being used by the author, he found much more constipation than at the present time because stronger mixtures were given. At that time smaller

quantities were given at each feeding, which necessitated adding a smaller quantity of water to the milk and sugar which was required to make up the proper number of calories. For instance, an infant weighing eleven and one-half pounds requiring fifty calories per pound must have 575 calories a day. Such an infant could take one and one-half ounces of sugar a day or 180 calories. This would leave 395 calories of milk or about twenty ounces. Formally the formula would be made up:

Milk	20 oz.	400 cals.	Seven feedings of four ounces each.
Water	10 oz.		
Sugar	1½ oz.	180 cals.	
		580 cals.	

This strong dilution would often cause constipation. At present we give five and a half to six ounces at a feeding, and would make up the formula:

Milk	20 oz.	400 cals.	Seven feedings of six ounces each.
Water	20 oz.		
Sugar	1½ oz.	180 cals.	
		580 cals.	

This dilution rarely causes constipation.

(7) **Excessive Vomiting or Lack of Appetite.**—For the same reason that too little food or too weak food will cause constipation, the infant who vomits the larger part of its food will be constipated. This is seen in pyloric stenosis, where the food is vomited instead of passing through the pylorus, or when for any reason a great part of the food is vomited. Lack of appetite acts in the same way, because insufficient food is taken.

Treatment.—The treatment of constipation due to these causes consists in treating the vomiting and lack of appetite. (See pages 208, 233.)

(8) **Boiled Milk.**—Just as boiled milk will help to control diarrhœa, so will it produce and aggravate constipation after the other digestive disturbances have been overcome by the boiled milk.

Treatment.—Where boiled milk has been used for vomiting or diarrhœa, and the symptoms have ceased and both the

milk and sugar have been increased up to the quantity that fulfils the infant's caloric requirements, the milk should no longer be boiled if there is constipation. This is also true of constipated infants not having had digestive disturbances, but who have been given boiled milk for some other reason. If vomiting is present, the constipation becomes secondary, and it is best to give an enema of plain water every day rather than to stop boiling the milk.

(9) **Cathartics.**—The most stubborn form of constipation that we have to deal with occurs in infants who have received daily doses of castor oil, castoria, rhubarb and soda, calomel, or any of the other active cathartics. If this abuse of cathartics has extended over a long period of time, it is almost impossible to overcome the constipation by dietetic measures. Enemas and suppositories, when used over a long period of time, are nearly as bad. When advising a cathartic or an enema a mother should always be told that it is only a temporary measure to make the bowels move until the food can be so changed as to permanently overcome the constipation.

Treatment.—If dietetic measures fail, milk of magnesia is the least harmful laxative to use. After six months of age, unsweetened apple-sauce, prune pulp, or other fruit juices may be used instead of the milk of magnesia. Orange juice should be given to all bottle-fed infants over two months of age whether they are constipated or not, provided there is no contra-indication. It is always well to begin orange juice in very small amounts, one teaspoonful twice a day, half way between two feedings, and each week the quantity is increased one teaspoonful at a time until the infant is getting the juice of half an orange twice a day. After one year of age, scraped raw apple is more laxative than orange juice. A ripe apple is cut in half with the skin on, the core taken out, and the apple is lightly scraped with a spoon, being careful to get no lumps in it. Only a teaspoonful should be given the first few days, and this amount gradually increased up to half an apple twice a day if neces-

sary to overcome the constipation. A ripe pear may be used in the same way. After eight months of age there are many laxative foods that can be used, and even though these stubborn cases have milk of magnesia up to this age, the constipation can be permanently cured by dietetic measures.

CASE XL

(Illustrating constipation from the excessive use of cathartics)

March 23: Age, 11 months 3 weeks. Present weight, 20 lb. 4 oz.
Birth weight, unknown.

General Condition.—Well nourished, well developed, good color, excellent musculature.

Stools.—Since eight months of age, when weaned from the breast, infant has been constipated. Various measures were tried to overcome it, and recently milk of magnesia, even a teaspoonful as often as three or four times a day, failed to move the bowels unless a soap and water enema was given every day.

Vomiting.—None.

Appetite.—Good.

Sleep.—Excellent.

Temperature, 98.6° F.

Chief Complaint.—Constipation.

Previous Food.—Breast-fed entirely for the first eight months; since then has had six or seven ounces of undiluted milk every three hours, besides the breast twice a day.

Treatment.—Stop milk of magnesia. Use suppository once a day if necessary. For diet given, see page 321.

April 6 (2 weeks later): The infant has taken the food well, and the bowels have moved once a day, a soft, normal movement without the use of a suppository during the last three or four days.

(10) Habit.—Habit has long been recognized as a cause of constipation in older children and adults, but enough emphasis has not been placed upon habit in infancy. At three or four months of age every infant, whether constipated or not, unless there is malnutrition or some other such contraindication, should be placed upon a vessel once or twice a day. It is astonishing to see how readily such young infants learn the meaning of this procedure. The vessel should be small, exactly fitting the infant's buttocks, and should be placed in the nurse's or mother's lap, and the infant's back supported while the bowels are being evacuated.

(11) Organic Lesions.—Fissures are usually caused by

previous constipation, the stool being so large and hard that in passing the anus a fissure is made. In addition to the constipation, then, the pain of evacuating the bowels prevents the infant from having a stool when the inclination is aroused. A stick of silver nitrate should be applied to the fissure once in three or four days until healed and the proper measures taken to overcome the cause of the original constipation.

An abnormally small anus is not infrequently seen. This condition should be remedied by stretching the anus every two or three days with the finger, first inserting the little finger for only a short distance and later the index-finger. Hemorrhoids and polypi are rarely seen in very young infants, but when they occur appropriate treatment should be used.

Treatment of Constipation That Has Resisted Dietetic Measures While Bottle-fed

Infants are occasionally seen who remain constipated in spite of all that can be done dietetically. After a faithful trial of dietetic measures, infants under six months of age may have milk of magnesia, used in as small quantities as will bring about one good-sized normal movement a day. It is best to begin by giving one teaspoonful of milk of magnesia in one or two bottles a day. If this does not suffice, the same amount may be given in one or two more of the bottles, and so on until enough is given to bring about a voluntary evacuation. It is particularly useful in infants too young to take orange juice or scraped fruits, and should be discontinued, if possible, so soon as the age of six or seven months is reached, when fruit juices can be substituted in fairly large quantities. If the milk of magnesia has to be continued longer than this, it does not do so much harm as the more violent cathartics, and during the second year, when the child is put upon solid food, the diet can be so regulated as to overcome the constipation permanently.

CHAPTER XIV

VOMITING IN BOTTLE-FED INFANTS

Vomiting in bottle-fed infants may be classified under two broad heads:

Acute vomiting.
Habitual vomiting.

These may be sub-classified according to their causes.

Acute Vomiting

Acute vomiting is that form which occurs suddenly in an infant who has previously been free of gastric disturbances or in an infant who has had gastro-intestinal disturbances of a more chronic nature. Acute vomiting with a sudden onset should not be confused with habitual vomiting, since the treatment differs greatly.

It may be subdivided according to cause into

(*a*) Acute indigestion caused by indigestible food unfit for the infant.

(*b*) Acute infectious gastro-enteritis.

(*c*) Miscellaneous causes: General infectious diseases such as pneumonia, acute exanthemata, etc., peritonitis, intestinal obstruction, nephritis, cerebral vomiting from meningitis, brain tumor, etc., drugs and poisons.

Only the first and second varieties of acute vomiting will be discussed here, since the others should receive treatment appropriate for the cause upon which they depend. These two classes of vomiting are usually easy to control and are, in fact, often self-limited, and, since they both are amenable to the same treatment, it is not necessary to discuss each separately.

TREATMENT OF ACUTE VOMITING

(1) Stop food and water
(2) Give sodium bicarbonate by mouth
(3) Empty the bowels
(4) Wash out the stomach
(5) Administer sedatives

(1) **Stop Food and Water.**—Often the chief reason why acute vomiting is difficult to control is because the stomach is not given a rest from food and water. Mothers are very apt to make this error, believing that nourishment is the essential part of any treatment, even in the beginning of an illness.

Do not allow anything by mouth, even water, for a few hours. This is a hard rule to follow, as the older infants and children suffer intensely from thirst and often beg piteously for water. If allowed to quench their thirst with a glass of water, it is immediately vomited and the thirst is as great as ever. The water satisfies for a moment only and aggravates the vomiting.

(2) **Give Sodium Bicarbonate by Mouth.**—After a few hours of abstinence from water, sodium bicarbonate, one level teaspoonful to a glass of water, may be used, giving one tablespoonful of this solution every ten or fifteen minutes. This is very effective in acute vomiting, particularly in older infants, and, except in most resistant cases, may be greatly relied upon to relieve the trouble. If a tablespoonful is retained, the amount may be increased, a tablespoonful at a time, until two or three ounces are taken without causing vomiting. As the quantity is increased it should be given at longer intervals, perhaps once an hour. After there has been no vomiting for ten or twelve hours, it is safe to try water without sodium bicarbonate, beginning with small quantities at first. If this is well borne, a very dilute food may be started. Infants under six months of age usually take one-third milk and two-thirds water, beginning with only two or three ounces at a feeding, and are fed once

in three hours. With infants between six months and a year it is best to try a weak barley gruel first, about a tablespoonful of barley flour to a pint of water. If this is not vomited, and provided there is no contra-indication in the condition of the bowels, weak milk feedings may be instituted after twelve or eighteen hours. Infants over a year of age, and particularly those who are not bottle-fed, may be fed a clear broth or bouillon, well heated, beginning with a tablespoonful at a time, or a malted milk mixture made with two heaping teaspoonfuls of malted milk to four ounces of water. Boiled skimmed milk and water, in equal parts, may be retained in the most persistent cases.

Although a period of abstinence from food is advisable and of great benefit at the beginning of vomiting, one occasionally sees infants that have been deprived of food too long in an attempt to stop obstinate vomiting. After a few hours total abstinence from food, or starvation, it is well to try one of the foods above suggested, because the vomiting may then often be stopped by giving the stomach something to work upon.

(3) **Empty the Bowels.**—At the beginning of an attack of acute vomiting one of the first things to do is to see that the gastro-intestinal tract is empty of any harmful contents. Unfortunately, cathartics are not easily retained and may even excite or increase the vomiting. For this reason it is best to give an enema first, using either soapsuds or glycerine and water. If a good evacuation is not obtained in this way, magnesium sulphate, half an ounce to four ounces of water, may be given by rectum, allowing it to be retained as long as possible. If the fever is high, it may be necessary to give some cathartic by mouth. Calomel has formerly been the cathartic of choice, especially for acute vomiting, but the author seldom uses it now as it seems to act as an irritant to the stomach. How often do we give divided doses of calomel to a child that is not vomiting, and after a few doses the most persistent emesis results! Castor oil, if given early or as soon as the stomach has been emptied of food, is the cathartic

FIG. 7.—Inserting the tube for stomach washing.

FIG. 8.—Pouring in the water for a stomach washing

Fig. 9.—Emptying the stomach.

of choice. Give a moderately small dose and repeat in one-half hour if it is vomited or in two hours if not vomited and the bowels have not moved. Two teaspoonfuls may be given to an infant under six months of age, and one tablespoonful to an infant over six months. Milk of magnesia in small repeated doses is often effective. Children over a year may have one teaspoonful every half hour for three doses, then every two hours until the bowels move.

(4) **Wash out the Stomach Once.**—(See "Lavage.") If the result with one washing is not successful, it is not desirable to repeat the process, as the second effort will not be any more successful than the first. A great deal of harm has been done by too frequent washing of the stomach.

(5) **Sedatives** will often do a great deal of good when the stomach has become so irritable that the vomiting cannot be stopped in any other way, particularly in cases of severe dysentery and cholera infantum. They should not be used until, through constant vomiting and purging, the stomach and bowels have been cleared of all the material that is causing the disturbance, nor should they be used when there is stupor or coma. Children over a year of age may have a single dose of phenacetin by mouth. When so given in single doses, phenacetin is not the formidable drug that we have been led to fear. One or two grains of the powder moistened with a teaspoonful of water may be given quite harmlessly.

Paregoric is an extremely useful drug in selected cases of severe vomiting. The only objection to its use is that it is not of uniform strength, and care must be taken to procure the official preparation. It should not be used until the bowels and stomach have been thoroughly emptied, nor where there is stupor or coma. Its beneficial effect in controlling vomiting is due to its sedative action upon the irritable stomach and to its general effect as an opiate. It should never be given in large enough doses to produce sleep so profound that the infant cannot be awakened for its food.

It is usually safe to give an infant of any size two drops every four hours, preferably before a feeding. The dose may be increased to two or four drops every two hours, provided the vomiting is not controlled by the smaller dose and provided the infant wakes at regular intervals for its feedings and takes them well.

Young infants or older ones who are not helped by the phenacetin or paregoric, particularly in severe dysentery or cholera infantum, may have subcutaneously morphine, gr. $\frac{1}{60}$, combined with atropine, gr. $\frac{1}{600}$. A single dose only should be given.

Case XLI

(Illustrating treatment of acute vomiting)

August 1: Age, 9 months. Weight, 19 lb. 8 oz.

General Condition.—Well nourished and developed, high color, restless.

Stools.—One normal a day until onset; since then none.

Vomiting.—Sudden onset eight hours ago, consisting first of food; since then only bile-stained water. Has vomited every fifteen minutes since onset.

Appetite.—Water taken greedily.

Sleep.—Has cried almost continuously since onset.

Temperature, 104° F.

Previous Food.—Has been properly bottle-fed since birth. Yesterday went on an all-day trip to the seashore, the milk being carried; possibly improper food was eaten. Since onset only water has been given.

Treatment.—Castor oil, one tablespoonful. Repeat in a half hour if vomited. Give one tablespoonful of a sodium bicarbonate solution (one teaspoonful to eight ounces of water) every ten minutes, gradually increasing the quantity if the vomiting stops. Food prescribed: Nothing allowed by mouth (not even water) except sodium bicarbonate solution.

August 2 (1 day later):

General Condition.—Quiet, contented.

Stools.—Six green stools containing undigested curds, small amount of mucus.

Vomiting.—Stopped after three or four hours.

Appetite.—Takes the sodium bicarbonate water, three or four ounces at a time.

Sleep.—Good throughout the night.

Temperature, 98.6° F.

There was no recurrence of the vomiting when small amounts of a weak food were allowed and gradually increased to the usual formula.

Case XLII

(Illustrating the use of paregoric for severe vomiting of three weeks' duration)

July 17: Age, 18 months. Weight, 13 lb. 8 oz.

General Condition.—Has become rapidly emaciated in the last three weeks, pale, in a condition of collapse, eyes sunken, extremely weak, apathetic, feeble cry, feet and hands cold.

Stools.—Small, green, mucous, very little fecal matter (with an enema of soapsuds) twice a day. Has never had any diarrhœa.

Vomiting.—Three weeks ago, sudden onset, previously well; vomited many times the first day; since then, up to the present time, has vomited almost everything taken by mouth, even water at times, causing the rapid emaciation, loss of strength, and small mucous stools.

Appetite.—Took liquids greedily until the last two days; since then will take very little.

Sleep.—Only fifteen minutes at a time, night or day, since onset.

Temperature, 101° F.

Chief Complaint.—Vomiting.

Previous Food.—Breast-fed the first year and did very well. For the last six months, in addition to the bottle, has received an irrational, irregular diet of solid food. Since onset has had clear broth, fruit juices, white of egg in water, crackers.

Treatment.—Paregoric, two mm. every four hours in one teaspoonful of water (given immediately before a feeding), to be increased to two or even three drops every two hours if the vomiting is not controlled. Strychnia, gr. $^1/_{200}$ every four hours before feedings. Stop soapsuds enemas; give enema of plain water once in 36 hours if the bowels do not move of their own accord.

Food prescribed:

Skimmed milk and water, equal parts, boiled, without sugar.	Feed 1½ oz. every 2 hours, 12 feedings in 24 hours.

July 18 (1 day later):

General Condition.—Slightly improved.

Stools.—Bowels have not moved.

Vomiting.—Only once since last visit.

Appetite.—Takes food well.

Sleep.—Better.

Treatment.—The paregoric having been increased to three drops every two hours, is now decreased to two drops every two hours. Strychnia continued.

Food prescribed:

Skimmed milk and water, equal parts, boiled, without sugar.	The quantity at each feeding to be increased ½ oz. at a time up to 3 oz. every two hours, 12 feedings in 24 hours.

July 19 (1 day later):

General Condition.—Much improved.

Stools.—One with enema.

Vomiting.—None since last visit.

Appetite.—Takes three ounces slowly but well every two hours.

Sleep.—Most of the time between feedings.

Treatment.—Paregoric decreased to two drops every four hours. Strychnia decreased to gr. $^1/_{400}$ every four hours.

Food prescribed:

Add one ounce of top milk taken from the quart to the remaining skimmed milk left in the quart bottle. Using this milk, make the food:

Skimmed milk ...	2 oz.	boiled	Feed 3 oz. every 2 hours, 12 feedings in 24 hours.
Water	1 oz.	boiled	
Sugar	0		

July 21 (2 days later):

General Condition.—Much improved, eyes no longer sunken, still weak.

Stools.—One voluntary.

Vomiting.—None.

Appetite.—Takes all the food offered.

Sleep.—A great deal.

Treatment.—Paregoric discontinued. Strychnia, gr. $^1/_{400}$ every four hours.

Food prescribed:

Each night and morning add one more ounce of the top milk to the full amount of skimmed milk contained in the quart, until full milk is used. Give this milk undiluted.	Feed 4 oz. every 3 hours, 8 feedings in 24 hours.

This patient, seen in consultation, was not under the author's direct observation after this period, but an eventual, although slow, recovery took place.

This was a case of acute vomiting of three weeks' duration, and food was very much needed. The boiled skimmed milk and water was easily retained when the gastric irritability was overcome by paregoric. The infant was so weak that it was also in great need of stimulation, and the strychnia was therefore begun. The bowels had not moved previous to the first visit because there was no residue, practically no food having passed into the intestines. It is a mistake to give soap and water and other irritating enemas or irrigations in such cases.

Habitual Vomiting

Habitual vomiting is a term applied to vomiting which occurs every day for at least a week and often for many weeks. Vomiting is not habitual unless it occurs after many or all the feedings.

Mothers are prone to exaggerate the importance of spitting up of a mouthful or two after the feeding, so that the physician must ascertain how much in quantity is vomited, how many times a day it occurs, and whether it occurs immediately after a feeding or just before, or continuously throughout the interval; and it is also well to ascertain whether the vomiting is projectile in character or not. Other things being equal, the more food vomited and the shorter the intervals, the more severe is the gastric indigestion. Vomiting that occurs just before a feeding time indicates that the gastric digestion is very much retarded or that the feedings are given too near together; vomiting that occurs immediately after a feeding only is of much less serious import, provided the quantity is not large. When all of the food is vomited at once, a few minutes after it is taken, and with such force that it is projected a distance of three or four feet, it may be considered as projectile vomiting. This form is seen in pyloric stenosis, meningitis, and in cases of intracranial pressure from other causes.

Causes of Habitual Vomiting.—Habitual vomiting in bottle-fed infants may be caused by

(1) Errors in the details of administering the food, such as irregular feeding, etc. (to be enumerated later).

(2) Indigestion from fat, sugar, starch, or overfeeding.

(3) Overfeeding in quantity.

(4) The hypertonic infant.

(5) Organic causes: Pyloric spasm or stenosis, dilatation of the stomach, gastroptosis, reflex vomiting.

An infant may have a combination of many or all of these

causes, so that it is not possible to divide the treatment into different methods. All cases must be looked into carefully and any of the above errors rectified if present.

(1) ERRORS IN DETAIL OF ADMINISTERING THE FOOD

The following are apt to be common mistakes made in the feeding of infants:

(*a*) Too rapid feeding.

(*b*) Too slow feeding.

(*c*) Feeding in a reclining position and leaving the infant to take the bottle alone.

(*d*) Not allowing the air swallowed during the nursing to be eructated before the feeding is complete by occasionally holding the infant in an upright position.

(*e*) Too long a nipple which gags the infant.

(*f*) Tossing the infant about or handling it too soon after feeding.

(*g*) Tight belly-band and clothing.

(*a*) **Too rapid feeding** is a detail that has been dwelt upon a great deal, and perhaps its importance has been somewhat exaggerated. It is best to have a small infant take fifteen or twenty minutes for a feeding, and, as this is difficult to accomplish in a very hungry baby whose feedings have been cut down on account of digestive disturbances, a nipple with an extremely small hole must be used. The mother should be instructed to select, from a large assortment, a nipple which has a hole so small that when held in front of the eye the light can scarcely be seen through it.

(*b*) The error of **feeding too slowly** is usually not sufficiently emphasized. Many weak, small infants are given a nipple with too small a hole and are allowed to nurse for one-half or three-quarters of an hour, or sometimes even an hour, before the food is taken. If such an infant is fed every two hours, it may be nursing almost twelve hours out

Fig. 10.—Correct way to give a bottle feeding.

of every twenty-four. This may seem an exaggerated statement, but one who does much infant feeding occasionally finds such instances. In such cases a nipple with a larger hole should be used. The hole should be large enough to allow the food to drop out freely when the bottle is turned upside down. The bottle should be given to the infant for twenty minutes only, and all that is not taken in that time should be discarded, no more food being allowed until the next feeding, when a fresh bottle is given.

Slow feeding also permits the infant to swallow air, and later, because the stomach is distended, the food is ejected instead of the air.

(*c*) **Feeding in a reclining position** and leaving the infant to take the bottle alone is another mistake. The most natural way for an infant to take the bottle is in a semi-upright position, because that is the usual and proper manner of feeding from the breast. When an infant is held in the lap the progress of every detail may be observed: how fast the food is being taken, whether it is all being taken, and whether the baby is swallowing air.

(*d*) **Not allowing the air to be eructated** while the baby is in an upright position is another error. X-ray plates of infants taken after a feeding always show an air bubble in the stomach. If these pictures are taken in an upright position, the air space is over the cardiac end of the stomach. If they are taken in a horizontal position, the air space is seen elsewhere, but usually *not* near the œsophagus. It is obvious that when the infant is in an upright position the air is eructated instead of the food. For this reason an infant who is vomiting right after a feeding, should be put upon the mother's shoulder three or four times during the feeding and patted upon the back until the air comes up. This is an expedient which many mothers have learned to use of their own accord, and one frequently sees the vomiting stopped at once in this way.

(*e*) **Too long a nipple** which gags the baby is liable to cause vomiting of all the food taken. It usually occurs at the end of the nursing and only once or twice a day, or even less frequently.

(*f*) **Tossing the baby about** or **handling too soon after a feeding** has long been recognized as a source of vomiting.

(*g*) **Tight belly-bands** undoubtedly cause vomiting. The infant strains and wriggles about with the feeling of distention which comes after feeding, and the belly-band helps the abdominal muscles to force the food through the cardiac end of the stomach instead of the pylorus. The belly-band, therefore, should be discarded in all infants who are vomiting badly. If the band is worn to correct a weak navel or one which shows any signs of hernia, a small piece of adhesive plaster strapped over the umbilicus may be substituted.

(2) INDIGESTION FROM FAT, SUGAR AND STARCH

A very useful method of treating habitual vomiting is that of feeding one-third milk and two-thirds water, boiled together with no sugar or a small amount of sugar. Fortunately the same treatment is useful in many cases of diarrhœa. Even if there is fat indigestion, the small amount of fat remaining in whole milk diluted three times will rarely do any harm. An exception to this statement is illustrated in the case preceding. When the vomiting is very severe and nothing has been retained over a long period, boiled skimmed milk and water without sugar is more apt to be well borne. Later the cream taken from the top of the bottle of milk may be gradually added to the skimmed milk until full milk, properly diluted, is used.

If the vomiting is due to sugar, it is easily controlled by stopping the artificial sugar altogether. Undoubtedly sugar is the greatest source of gastric indigestion, as, when once under control, increasing the strength of the milk rarely causes the vomiting to return, while a too rapid

increase in sugar, or increasing the sugar to too great a quantity in the twenty-four-hour amount, very often causes a recurrence.

If starch indigestion is present, the vomiting is stopped by diluting the milk with water instead of gruels, and the author has seen many young infants who continued to vomit until this was done.

Boiling the milk makes it less coagulable,—that is, retards coagulation in the stomach.

Case XLIII

(Illustrating habitual vomiting controlled by regulating the amount of sugar and the intervals of feeding)

December 29: Age, 3 months 2 weeks. Birth weight, 5 lb.
Present weight, 7 lb. 7 oz.

General Condition.—Very poorly nourished, pale, poor musculature, head asymmetrical and other signs of rickets, cries vigorously. Needs from 60 to 65 calories per pound per day.

Stools.—One normal stool with a teaspoonful of castor oil every night.

Vomiting.—Has vomited more or less since birth. For the last few weeks has vomited a great deal after each feeding and throughout the intervals between feedings.

Appetite.—Poor; leaves half of a feeding two or three times a day.

Sleep.—Poor; cries three hours during the night and a great deal during the day.

Temperature, 98.6° F.

Chief Complaint.—Vomiting.

Previous Food.—Bottle-fed since birth, various foods the first six weeks; since then the following formula, the quantity of milk and sugar being occasionally changed:

Milk	10 oz.	boiled	200 cals.	Fed 3½ oz. every 2 hours, 10 feedings in 24 hours, not all taken.
Water	24 oz.	boiled		
Malt sugar....	2 oz.		240 cals.	
			440 calories, or 59– calories per pound.	

Treatment.—Stop giving castor oil, and give an enema once a day if the bowels will not move without it.

Food prescribed:

Milk	12 oz.	boiled	Divide into 7 bottles. Feed 4+ oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water..........	18 oz.	boiled	
Dextri-maltose ..	¼ oz.		

Each day increase the milk one ounce and decrease the water the same amount up to

Milk	15 oz.	boiled.	300 cals.
Water	15 oz.		
Dextri-maltose	¼ oz.		30 cals.
			330 cals., or 44 calories per pound.

January 6 (8 days later): Weight, 7 lb. 5 oz.
Loss, 2 oz.

General Condition.—As at last visit.
Stools.—One hard with enema.
Vomiting.—A little after each feeding.
Appetite.—Excellent, all the food taken.
Sleep.—Better.

Treatment.—Food prescribed:

Milk	15 oz.	boiled	300 calories	Divide into 7 bottles. Feed 4+ oz. every 3 hours as before.
Water.........	15 oz.			
Dextri-maltose .	¾ oz.		90 calories	
(by gradual increase)				
			390 calories, or 53– calories per pound.	

January 14 (8 days later): Weight, 7 lb. 9 oz.
Gain, 4 oz.

General Condition.—Improved.
Stools.—Two normal.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Poor.

Treatment.—Food prescribed:

Milk	16 oz.	boiled	320 calories	Divide into 7 bottles. Feed 4½ oz. every 3 hours as before.
Water.........	16 oz.			
Dextri-maltose .	1 oz.		120 calories	
			440 calories, or 59 calories per pound.	

January 21 (7 days later). Weight, 8 lb. 1 oz.
Gain, 8 oz.

General Condition.—Improved.
Stools.—Two normal.
Vomiting.—None.
Appetite.—Good.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	18 oz.	boiled	360 calories	Divide into 7 bottles. Feed 5+ oz. every 3 hours.
Water.........	18 oz.			
Dextri-maltose .	1 oz.		120 calories	
			480 calories, or 60– calories per pound.	

At the first visit there were both lack of appetite and a great deal of gastric indigestion caused by the large quantity of sugar. It was not necessary to stop the sugar altogether, which is often the case in infants who have been given excessive amounts of sugar. Two ounces of sugar in twenty-four hours for a 7½-pound infant is far too much, whether there is vomiting or not. It was thought advisable at the first to lengthen the intervals from two to three hours, since the vomiting was almost continuous and occurred immediately before a feeding was due. It will be seen that the vomiting was very much diminished in eight days, and a week later had stopped altogether. The appetite improved at the same time.

One must be always on his guard not to allow a very weak, emaciated infant to remain too long upon a weak milk and water diet, containing no sugar. If such an infant loses rapidly in weight, he may die from the lack of food and from loss of body fluids. If this rapid drop in weight or collapse occurs, the vomiting must be disregarded and half an ounce of sugar added at once to the twenty-four-hour amount. The sugar will cause water retention within the body and an immediate gain in weight, and thus help to tide the infant over a critical period.

Case XLIV

(Illustrating the danger of omitting the sugar in a weak infant)

February 27: Age, 4 months 1 week. Birth weight, 4 lb. 5 oz.
Present weight, 6 lb.

General Condition.—Extremely emaciated, pale, apathetic, feeble cry. Needs from 60 to 65 calories per pound per day.

Stools.—Constipated since birth; one hard stool with glycerine suppository.

Vomiting.—Since birth, large quantities throughout the intervals between feedings; never projectile. Almost all of the feeding ejected.

Appetite.—Ravenous; takes water between feedings.

Sleep.—Poor; cries night and day.

Temperature, 98.6° F.

Chief Complaint.—Vomiting, emaciation.

Previous Food.—Nursed mother's breast for the first six weeks of life, when a wet nurse was secured for six weeks. During the period of wet nursing the child gained one pound and twelve ounces, but on account of the vomiting the wet nurse was unwisely discontinued. Since then various proprietary foods were used, and for the last two weeks:

Buttermilk boiled with rice flour 2 oz. every 2 hours, 10 feedings in 24 hours.

Treatment.—Food prescribed:

Milk	8 oz.	boiled	Divide into 10 bottles. Feed 2 oz. every 2 hours. Increase ¼ oz. a day up to 3 oz. at a feeding.
Water	24 oz.	boiled	
Sugar	0		

Since the patient lived a hundred miles out of town and could be seen but once a week, directions were given to put one teaspoonful of malt sugar in the food in two days, whether the vomiting had stopped or not. In two more days the sugar was to be increased to two teaspoonfuls, and the patient was to return in one week. These directions were not obeyed for fear of a return of the vomiting, as the baby had never before vomited as little as it did on this boiled milk and water diet. When the infant was brought to the office a week later this failure to carry out directions in regard to the sugar resulted in the loss of weight and general condition indicated below.

March 5 (7 days later): Weight, 5 lb. 3 oz.
Loss, 13 oz.

General Condition.—Too weak even to move head from side to side, eyes sunken, loss in weight of 13 ounces during the week. This condition was due to the error of keeping the infant so long on a weak food without any sugar when emaciation was already marked.

Stools.—One hard, dry stool (with suppository).

Vomiting.—Much better, vomits only a mouthful occasionally.

Appetite.—Good; takes three ounces at a feeding.

Sleep.—Good.

Treatment.—Food prescribed:

Milk	10 oz.	boiled	Divide into 10 bottles. Feed 3 oz. every 2 hours, at 6, 8, 10, 12 A.M., 2, 4, 6, 8, 10 P.M., and 2 A.M.
Water	20 oz.	boiled	
Dextri-maltose...	½ oz.		

March 8 (3 days later): Weight, 5 lb. 8 oz.
Gain, 5 oz.

General Condition.—Much improved.
Stools.—One hard, dry.
Vomiting.—Little.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	12 oz.	boiled	240 calories	Divide into 10 bottles. Feed 3 oz. every 2 hours, as before.
Water...........	18 oz.	boiled		
Dextri-maltose ..	½ oz.		60 calories	
			300 calories, or 55− calories per pound.	

March 12 (4 days later): Weight, 5 lb. 13 oz.
Gain, 5 oz.

General Condition.—Still more improved.
Stools.—One hard, dry.
Vomiting.—Little.
Appetite.—Good.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	14 oz.	boiled	280 calories	Feed 3 oz. every two hours as before, 10 feedings in 24 hours.
Water...........	16 oz.	boiled		
Dextri-maltose ..	¾ oz.		90 calories	
			370 calories, or 63− calories per pound.	

March 20 (8 days later): Weight, 6 lb. 4 oz.
Gain, 7 oz.

General Condition.—Still more improved.
Stools.—Two normal without enema.
Vomiting.—None.
Appetite.—Good.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	15 oz.	boiled	300 calories	Feed 3 oz. every 2 hours, 10 feedings in 24 hours as before.
Water...........	15 oz.	boiled		
Dextri-maltose ..	¾ oz.		90 calories	
			390 calories, or 63− calories per pound.	

With the exception of one brief period when there was no gain in weight, this infant gained progressively and never vomited again to any extent.

The above description cannot do justice to the remarkable improvement occurring in an infant that was almost moribund at the second visit.

Dry milk is well borne in vomiting cases caused by indigestion from fat, sugar and starch. It is low in fat, no artificial sugar need be added to it at first, and the proteid is more easily digested than even the proteid of boiled milk. The following case illustrates its use:

CASE XLV

(Illustrating the use of Dry Milk in vomiting)

December 23: Age, 2 months. Weight, 9 lb. 4 oz.
Birth weight, 10 lb.
Loss since birth, 12 oz.

General Condition.—Pale, emaciated.
Stools.—One small, constipated with enema.
Vomiting.—Beginning at three weeks of age and increasing in frequency and quantity. Lately only a small portion of food retained.
Appetite.—Ravenous.
Sleep.—Cries night and day.
Temperature, 98.6° F.
Chief Complaint.—Vomiting, crying, loss of weight.
Previous Food.—(1) Eagle Brand condensed milk, (2) top milk with milk sugar, (3) Eskay's food with whole milk and water, (4) skimmed milk with dextri-maltose.

Treatment.—Food prescribed:

Dry milk .... 1 level tablespoonful
Water........ 2 oz.

Feed 2 oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 9 P.M., and 2 A.M.

December 25: Weight, 9 lb. 4 oz.
No gain, no loss.

General Condition.—Unchanged.
Stools.—One large, constipated, with enema.
Vomiting.—Has not vomited once after beginning dry milk.
Appetite.—Hungry.
Sleep.—Better, but cries a good deal.

Treatment.—Food prescribed:

Dry milk .... 2 tablespoonfuls (in two days increase to 3 tablespoonfuls)
Water............... 3 oz.

Feed 3 oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.

December 30: Weight, 9 lb. 15 oz.
Gain, 11 oz.

General Condition.—Improved.
Stools.—One normal daily.
Vomiting.—Vomited twice during the week.
Appetite.—Hungry.
Sleep.—Much better.

Treatment.—Food prescribed:

Dry milk	4 tablespoonfuls	Feed 4 oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water	4 oz.	

She gained thirteen ounces the following week and continued to gain and prosper. On July 16th, when nine months of age, she weighed twenty-four pounds, having had no other food but the dry milk and orange juice throughout these seven months. Her color was good, the musculature was excellent and there were no evidences of rickets or other nutritional disturbances.

(3) OVERFEEDING IN QUANTITY

It is rarely necessary to decrease the bulk of the feeding or lengthen the intervals when boiled milk and water feedings are given without sugar, provided the intervals are of the proper length and provided the bulk is not excessive for the infant's size and age (see p. 75). Occasionally the bulk or the amount at each feeding must be diminished, even if this necessitates making the food stronger, in order to get in the proper amount of nourishment. A strong milk-and-water mixture will often be better retained when given in small amounts than a weak food that is given in too large quantities at a feeding. This is particularly true of infants who, through overfeeding, have a dilated stomach or gastroptosis. An infant that is getting an excessive quantity at a feeding, say eight ounces every two hours (not an uncommon occurrence), would have to have this amount reduced to the correct quantity for his age and weight.

An infant that is being fed too often, say every hour or whenever it cries, or at extremely irregular intervals, should have this error corrected.

Well-nourished infants under six months of age or sixteen pounds in weight should be fed once in three hours from 6 A.M. to 10 P.M., whether there is vomiting or not. Infants of six months of age who weigh more than sixteen pounds should be fed every four hours, five feedings in twenty-four hours. If the infant is under four or five pounds and if there is a severe grade of emaciation, diarrhœa, and other gastro-intestinal symptoms, it is best to start with two-hour

intervals from 6 A.M. until 10 P.M., with one feeding at 2 A.M. —ten feedings in twenty-four hours. If the vomiting does not stop, or if it recurs when the sugar is added, two and one-half-hour intervals from 6 A.M. to 10 P.M. and one 2 A.M. feeding, making eight feedings in twenty-four hours, should be tried. If the vomiting still remains unabated, three-hour intervals from 6 A.M. to 10 P.M., with one feeding at 2 A.M., making seven feedings in twenty-four hours, may be used. The author has not found it necessary to use the four-hour intervals for any infant under six months of age or sixteen pounds in weight, although he is cognizant of the fact that many pediatricians have used these long intervals with excellent results.

Recently X-ray work has thrown a great deal of light upon the subject of motility and the emptying time of the stomach. The work of numerous investigators has explained many facts learned by clinical experience and seemingly contradicted by investigators working with the stomach-tube. Pisek has shown that when food is given with the stomach-tube the stomach begins to empty itself immediately —in fact, before the infant can be brought to the X-ray plate. The distention caused by the food brings about an active peristalsis, so that most of the food leaves the stomach within one and one-half to two and one-half hours. The food remaining after this length of time may not leave the stomach for four and one-half to seven and one-half hours, unless more food is given, when the residue from the former feeding is immediately expelled through the pylorus. This fact would indicate one of two things: either the bismuth used in the food for X-ray purposes retards the exit of this last remaining portion of the food, or the stomach of the infant is not intended to empty entirely before another feeding is given. Ladd has shown that the time it takes the stomach to empty depends also upon the food given and upon the individual infant, facts which are axioms of clinical observers. He has also shown that the less coagulable

the protein the sooner it leaves the stomach, and that easily coagulated proteins delay the emptying of the stomach greatly. He has used the curds (casein) dried, which are soluble in alkaline liquids, and almost instantly cleared up gastric symptoms in some instances. Boiling the milk makes it less coagulable,—that is, retards coagulation in the stomach,—and that is one of the reasons the stomach empties so much more quickly and vomiting stops when boiled milk and water mixtures are used.

Case XLVI

(Illustrating habitual vomiting from overfeeding in quantity, as well as from too much sugar.

May 24: Age, 8 months. Weight, 15 lb. 3 oz.

General Condition.—Fairly well nourished, fair musculature, no rickets. Needs 50 calories per pound per day.

Stools.—Two a day, brownish yellow, occasionally loose in consistency, with mucus; no curds.

Vomiting.—Has always vomited some, but in the last six weeks the vomiting has been more profuse throughout the interval.

Appetite.—Fair; occasionally leaves two or three ounces.

Sleep.—Fairly good.

Temperature, 98.6° F.

Chief Complaint.—Vomiting.

Previous Food.—Infant had been artificially fed since birth with milk, barley gruel, and cane sugar mixture in gradually increased quantities. At present:

Milk (unboiled)	40 oz.	800 calories	Fed 8 oz. every 2 hours, 9 or
Barley gruel	40 oz.	100 calories	10 feedings in 24 hours;
Cane sugar	2 oz.	240 calories	not all taken.
		1140 calories, or 75+ calories per pound.	

Each feeding has been made separately with four ounces of milk, four ounces of barley gruel, and one lump of sugar. The total twenty-four-hour amount should be estimated as above, even when the food has not been thus made.

Treatment.—Food prescribed:

Milk	24 oz.	boiled	480 calories	Divide into 6 feedings. Feed
Water...........	24 oz.	boiled		8 ounces every 3 hours, at
Cane sugar	½ oz.		60 calories	6, 9, 12 A.M., 3, 6, 10 P.M.
			540 calories, or 36– calories per pound.	

May 28 (4 days later): Weight, 15 lb. 3 oz.
No gain or loss.

General Condition.—As at last visit.
Stools.—Two yellow, firm; no mucus.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	28 oz.	boiled	560 calories	Divide into 6 feedings. Feed 8 oz. every 3 hours as before.
Water...........	20 oz.			
Cane sugar	1 oz.		120 calories	

680 calories, or 45– calories per pound.

May 31 (3 days later): Weight, 15 lb. 5 oz.
Gain, 2 oz.

General Condition.—Improved.
Stools.—Constipated; one hard (voluntary).
Vomiting.—None.
Appetite.—Good.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	28 oz.	boiled	560 calories	Divide into 6 feedings. Feed 8 oz. every 3 hours as before.
Water	20 oz.			
Cane sugar.	1½ oz.		180 calories	

740 calories, or approximately 49 calories per pound.

This infant continued to improve, and within the next week, the caloric requirements being fulfilled, gained nine ounces. If the appetite had been good and the infant had taken all of the food given, before it came under treatment for the vomiting, it would have been getting at least half as much again in food value as needed, and nearly twice as much in the total twenty-four-hour quantity. This was a case of vomiting and lack of appetite due to overfeeding, too frequent feeding, and too much sugar.

(4) THE HYPERTONIC INFANT

Haas has recently called attention to a class of vomiting infants which have a definite clinical entity, which he calls the hypertonic infant and of which he says: "It is characterized by hypertonicity of all the skeletal muscles, as shown by the ability to raise the head and grasp objects even in the early days of life, and by general spasticity. The hollow viscera show increased activity of their smooth muscle fibres.

This expresses itself in the form of spasm involving practically every part of the digestive tube, and, depending on the region, presents the symptoms of colic, visible peristalsis, vomiting, constipation or any combination of these. Accompanying these symptoms is a marked psychic irritability, expressed by insomnia, general restlessness and crying. The hypertonic infant belongs to the *Spasmophilic* group.

"Cases of this type present, in order of their importance:

"1. *Vomiting*, which, as before mentioned, is characteristically irregular, often with visible peristalsis.

"2. *Crying*, which is often more or less violent.

"3. *Insomnia;* this is usually a striking symptom, and with the crying creates a household state or condition bordering on demoralization.

"4. *Constipation*, resistant to ordinary laxative and dietetic treatment, and distinctly spastic in type, the stool being soft after it is once started.

"5. *Cold extremities*, with pallor, cyanosis and subnormal temperature. This is met with only occasionally.

"6. *Underweight*, the degree depending on the age at which correct treatment is instituted—under eight weeks, one to one and a half pounds; from three to six months, three to four pounds." (Haas, from the *American Journal of Diseases of Children*, May, 1918.)

This type of infant is so common that it is remarkable that no one else has ever before so classified them, but equally important is the discovery of the correct treatment. These infants vomit profusely and frequently; they cry night and day. Even the most skilful infant feeders have difficulty in controlling the vomiting and other symptoms dietetically, but Haas in his original communication announced that "treatment by the drug *atropin* is followed by rapid subsidence of symptoms, the results being so prompt and regular as to constitute specific action." The author is just as enthusiastic about the uses of *atropin* as the origi-

nator. Repeatedly he has seen the vomiting cease after the first dose of *atropin,* and, within a few hours, the infant stop crying and change immediately from a fretful, irritable infant into a normal one. This is not to be interpreted as meaning that the improperly fed infant will stop vomiting when given *atropin,* for that is not the type of infant who is meant to receive this treatment. It is the infant whose feedings have been properly managed and who, in spite of the most careful attention, still vomits and cries as much as ever. The *atropin* is administered in the following manner:

℞
Atropin ....gr. i
Water ....℥ii
(1 : 1000 solution)
Sig.—One drop in each feeding. Put into the bottle.

One grain to the ounce of water makes a solution of which each drop contains grains 1/480. This, then, is the dose to start with. If within forty-eight hours the symptoms are not very much improved, or if the vomiting recurs at any time, the dose would be increased to two drops in each feeding. In almost every case two drops will act so promptly that it is not necessary to increase it further, but if it does not, it is safe to increase the dose to even seven or eight drops (at intervals of one or two days). The hypertonic infant is not sensitive to *atropin,* but one should be on the lookout for its toxic manifestations, which are flushing, restlessness, vomiting, diarrhœa, hyperpyrexia and abdominal distention. *Atropin* is so much of a specific that if it fails to stop the vomiting it is of diagnostic value; that is, a mistake in the diagnosis has been made. It is not of value in acute vomiting nor in habitual vomiting due to incorrect feeding.

Case XLVII

(Illustrating the use of *atropin* in vomiting of the hypertonic infant)

March 25: Age, 5 weeks. Weight, 8 lb. 11 oz.
Birth weight, 8 lb. 12 oz.

General Condition.—Muscular type, cold feet, poorly nourished.
Stools.—Constipated stool with suppository each day.
Vomiting.—Almost every feeding, seemingly all that was taken, occasionally projectile.
Appetite.—Hungry.
Sleep.—Cries night and day.
Temperature, 98.6° F.
Chief Complaint.—Vomiting, colic.

Previous Food:

Milk	9 oz.	Fed 3 oz. every 2–3 hours; 8 bottles in 24 hours.
Water	15 oz.	
Dextri-maltose	6 tablespoonfuls	

Treatment.—(1 : 1000 *atropin* solution, 1 drop in each bottle.) Food prescribed:

Dry milk	1, increased to 2 tbs.	Feed 3 oz. every 3 hours, at 6 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water.........	3 oz.	

April 1: Weight, 8 lb. 15 oz.
Gain, 4 oz.

General Condition.—Same.
Stools.—One firm with suppository.
Vomiting.—A little after each feeding.
Appetite.—Hungry.
Sleep.—Better, but still cried a good deal.
Treatment.—Increase *atropin* solution to two drops in each feeding.

Dry milk	2 later 3 tablespoonfuls	Feed 4 oz. every 3 hours, at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water	3 later 4 oz.	

April 8: Weight, 10 lb. 4 oz.
Gain, 1 lb. 5 oz. in 7 days.

General Condition.—Much improved.
Stools.—Three to four firm, normal.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Excellent.
Treatment.—Atropin 2 drops in each bottle.

Food Prescribed:

Dry milk	3½ tablespoonfuls	Feed 4½ oz. every 3 hours, at 6, 9, 12 A.M., 3, 6 ,10 P.M., and 2 A.M.
Water	4½ oz.	

April 15: Weight, 10 lb. 13 oz.
Gain, 9 oz. in 7 days.

General Condition.—Excellent.
Stools.—Three large, firm, normal.

Vomiting.—None.
Appetite.—Good.
Sleep.—Good.
Treatment.—Food prescribed:

Dry milk	4 tablespoonfuls	Feed 5 oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water	5 oz.	

On June third, six weeks later, the baby weighed fourteen pounds four ounces. There had been no recurrence of the vomiting and colic and the *atropin* was discontinued.

(5) ORGANIC CAUSES OF VOMITING

Reflex vomiting will not be discussed here. Pyloric stenosis and spasm of the pyloris are two diseases with which physicians should be familiar but which will only be briefly discussed as they more properly belong to a textbook on pediatrics. Symptoms which are common to both are projectile vomiting, constipation, emaciation, loss of weight or failure to gain in weight. Visible peristalsis is commonly seen in the spasm of the pylorus but is more marked in a true organic stenosis (obstruction). In organic stenosis a mass may be felt in the right epigastrium by the skilled palpator. It is never felt in spasm of the pylorus. These two conditions may be differentiated by X-ray, by the extent and constancy of the vomiting, and by the amount of food which gets through the pylorus, as determined by the size and quantity of the stools and the degree of emaciation. The administration of *atropin* is of additional aid in the differential diagnosis, since it will control the vomiting of pyloric spasm, while it will have no effect on organic stenosis. In cases where pyloric spasm is suspected *atropin* treatment should be started at once and is just the same as for the hypertonic infant (see page 230). On the other hand, true organic obstruction should be operated upon at once, since the mortality for the Rahmstead operation is very low indeed when done early.

CHAPTER XV

LOSS OF APPETITE IN BOTTLE-FED INFANTS

Loss of appetite in bottle-fed infants is evidenced by the infant's failure to take all the food offered at any or all the feedings, and it may at times be a very serious condition. It is very important for an infant to take all the food that is planned for it, since it is useless carefully to reckon the needs of an individual infant when it is getting only a portion of the food it requires. Unfortunately an infant's appetite is not always a proper guide to its needs. It is difficult to get some infants to take food that is sufficient in strength and quantity, while others will, if permitted, take ravenously enough food to give them gastric or intestinal indigestion. This excessive appetite is often more marked when indigestion is already present.

A lack of appetite is noticeable in five classes of infants:

(1) Those who are wrongly fed or overfed or irregularly fed.

(2) Those properly fed, who have a very narrow margin between their digestive capacity and the amount of food that they need to make a gain in weight.

(3) Small, emaciated infants who are too weak to take the food. These infants are usually also wrongly fed.

(4) Infants with sore mouth or throat or some other pathological condition which makes it painful or difficult for the infant to swallow.

(5) Infants who dislike the taste of the food.

(1) **Infants Who are Wrongly Fed or Overfed.**—It is not at all difficult to overcome loss of appetite in infants who are wrongly fed or overfed. Fortunately again, the same treatment which helps most of the cases of diarrhœa and vomiting is beneficial in increasing the appetite, so that the

usual mixture of one-third milk and two-thirds water (or half milk and half water for the larger infants who have been accustomed to strong milk mixtures) will cause the appetite of these infants to increase in a very few days, sometimes inside of twenty-four hours. The sugar should be reduced or taken from the food altogether, and, if top milks are used, it is best to substitute whole-milk mixtures for them.

Unless the infant is feeble and greatly undersized, the intervals between feedings should be increased to three hours, giving either six or seven feedings in twenty-four hours, the food being given in the proper quantity for the age (see p. 75). It is never best to cut down the quantity at a feeding simply because the infant does not take all that is given, unless the quantity has been excessive. If the sugar is stopped and the dilution given as suggested above, the infant will take the proper quantity. The sugar should not be added nor the food increased to a sufficient strength to supply the infant's needs (caloric requirements) until the proper quantity is taken at each feeding. Then the increase should be made in the usual gradual manner.

Case XLVIII

(Illustrating loss of appetite and its control by reducing the amount of milk and sugar and lengthening the intervals between feedings)

March 23: Age, 7 months 3 weeks. Birth weight, 6¾ lb.
Present weight, 15 lb.

General Condition.—Fairly well nourished, somewhat pale, good musculature. Caloric needs, 50 calories per pound per day.

Stools.—Two a day with enema; castor oil occasionally.

Vomiting.—Every day a little.

Appetite.—For last six days poor; *leaves four ounces every feeding.*

Sleep.—Restless at night. Sleeps two hours in the morning and one hour in the afternoon.

Temperature, 98.6° F.

Chief Complaint.—Loss of appetite.

Previous Food.—Infant had been breast-fed for six weeks; since then had milk, water, and sugar mixtures of various strengths. For four weeks:

Milk .... 29 oz.	unboiled		Fed 7 ounces every 2½ hours, 8 feedings in 24 hours.
Water .... 24 oz.	unboiled		
Cane sugar .... 1½ oz.			
Peptogenic milk powder .. 2 oz.			

Treatment.—Food prescribed:

Milk .... 28 oz.	unboiled	560 cals.	Divide into 6 feedings. Feed 8 ounces every 3 hours, at 6, 9, 12 A.M., 3, 6, 10 P.M.
Water .... 20 oz.	unboiled		
Cane sugar ...... ½ oz.		60 cals.	
		620 cals.	41 calories per pound.

March 27 (4 days later): Weight, 15 lb.
No gain or loss.

General Condition.—As at last visit.
Stools.—Two normal with enema or castor oil.
Vomiting.—None.
Appetite.—*Hungry: takes all the food ravenously.*
Sleep.—Restless.
Temperature.—Same.
Treatment.—Food given:

Milk .... 28 oz.	unboiled	560 cals.	Divide into 6 feedings. Feed 8 ounces every 3 hours as before.
Water .... 20 oz.	unboiled		
Cane sugar ....1–1½ oz.		180 cals.	
		740 cals.	50 calories per pound.

In three days, if still hungry, increase sugar to one and a half ounces.

April 4 (8 days later): Weight, 15 lb. 9 oz.
Gain, 9 oz.

General Condition.—As at last visit.
Stools.—One normal.
Vomiting.—None.
Appetite.—Good; all the food taken.
Sleep.—Good.

This infant continued to do well, and at eleven months of age was of normal weight. It had been getting a great deal too much food as well as an excess of sugar, since the peptogenic milk powder is made largely of milk sugar and pancreatin, and two ounces of this plus one and a half ounces of cane sugar made three and a half ounces of sugar in all. The mother objected at first to the change in feeding made at the first visit, because she considered the peptonizing essential to prevent indigestion. It will be seen

how the digestion was improved after the peptogenic milk powder was stopped.

CASE XLIX

(Illustrating loss of appetite from overfeeding)

June 19: Age, 6 months. Birth weight, 4 lb. (?) (premature).
Present weight, 7 lb. 4 oz.

General Condition.—Emaciated, pale, poor musculature, no evidences of rickets, feeble cry. Caloric needs 65 per pound per day.

Stools.—For three months, constipated; one light yellow, hard stool with an enema each day.

Vomiting.—None.

Appetite.—Takes less than half the feeding.

Sleep.—Poor; cries night and day.

Temperature, 98° F.

Chief Complaint.—Loss of appetite, emaciation.

Previous Food and Feeding History.—First month of life fed Eagle brand condensed milk, second and third months Horlick's malted milk, fourth and fifth months malted milk with gradually increased amounts of cow's milk. For two weeks:

Milk	28 oz.	unboiled	560 calories	8 oz. every 3 hours, 7 feedings in 24 hours.
Water	28 oz.	unboiled		
Malt sugar ...	2 oz.		240 calories	
			800 calories, or 110+ calories per pound.	

Treatment.—Food prescribed:

Milk	18 oz.	unboiled	360 calories	Divide into 7 bottles. Feed 5 oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water	18 oz.	unboiled		
Sugar..........	0			
			or 50– per pound.	

June 23 (4 days later): Weight, 7 lb. 4 oz.

General Condition.—Somewhat improved.

Stools.—One a day with enema.

Vomiting.—None.

Appetite.—Takes all food eagerly.

Sleep.—Better.

Treatment.—Food prescribed:

Milk	18 oz.	unboiled	360 calories	Divide into 7 feedings. Feed 5 oz. every 3 hours as before.
Water	18 oz.	unboiled		
Malt sugar ..	¼ oz.		60 calories	
			420 calories, or 55– per pound.	

This baby continued to take the food well, and the sugar was gradually increased to one ounce in the twenty-four-hour amount.

(2) Babies properly fed, who have a very narrow margin between their digestive capacity and the amount of food that they need to make a gain in weight, are more difficult to treat. Occasionally one sees an infant who gains but slowly when given the proper amount of milk, water, and sugar, and whose appetite is not good. If an infant cannot be made to take the amount of food it needs, it will not gain in weight. For such an infant the food requirements must be carefully reckoned. Because of this very narrow margin, a few ounces of milk more than is needed will spoil the appetite, even though there is no diarrhœa or vomiting.

The best that can be done in such cases is to cut down the food, particularly the sugar, to the quantity that the infant will take well, and not expect a gain in weight until after the appetite has returned. The intervals may be lengthened to three hours or, in infants over eight months of age, even to four hours. When the appetite has returned so that all of the food is eagerly taken, the sugar and milk may be gradually increased, being careful not to exceed the amount that will cause a return of the loss of appetite. Such children may not be expected to gain weight very fast, a gain of three or four ounces a week, while the tendency to lack of appetite persists, being all that may be expected.

Occasionally strychnia, gr. $\frac{1}{300}$ to $\frac{1}{500}$ given every six hours before a feeding, will improve the appetite.

Case L

(Illustrating a case in which loss of appetite repeatedly recurred whenever the food was increased beyond the infant's minimum caloric requirements)

March 2: Age, 4 months 2 weeks. Birth weight, 5 lb. 10 oz.
Present weight, 9 lb. 2 oz.
(Lowest weight at 1 month of age, 4 lb. 8 oz.)

General Condition.—Undersized, fairly well nourished, pale, rickets. Caloric needs for an 8 oz. weekly gain, 55 calories per pound per day.

Stools.—One or two yellow, normal stools a day following varying amounts of milk of magnesia.

Vomiting.—None.
Appetite.—Leaves an ounce or two at each feeding.
Sleep.—Good, night and day.
Temperature, 98.6° F.
Chief Complaint.—Poor appetite.

Previous Food:

Skimmed milk......	16 oz.	unboiled	Fed 4 oz. every 3 hours, 7 feedings in 24 hours.
20 per cent. cream...	4 oz.	unboiled	
Water.............	20 oz.		
Imperial granum... (Milk not boiled with imperial granum)	5 tbsp.		

Treatment.—Food prescribed:

Milk.....	16 oz.	boiled	320 calories	Divide into 7 bottles. Feed 4½ oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water ...	16 oz.	boiled		
Sugar....	0			

March 6 (4 days later): Weight, 9 lb. 2 oz.
No gain or loss.

General Condition.—As above.
Stools.—Constipated; one hard with enema.
Vomiting.—None.
Appetite.—Good; takes all the food.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	18 oz.	boiled	360 calories	Divide into 7 bottles. Feed 5+ oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M., 2 A.M.
Water..........	18 oz.	boiled		
Dextri-maltose...	½ oz.		60 calories	
			——	
			420 calories, or 47– calories per pound.	

March 10 (4 days later): Weight, 9 lb. 4 oz.
Gain, 2 oz.

General Condition.—Improved.
Stools.—One normal.
Vomiting.—None.
Appetite.—Takes all the food.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	18 oz.	boiled	360 calories	Divide into 7 bottles and feed as before.
Water.........	18 oz.	boiled		
Dextri-maltose..	1 oz.		120 calories	
			——	
			480 calories, cr 52– calories per pound.	

March 16 (6 days later): Weight, 9 lb. 6 oz.
Gain, 2 oz.

General Condition.—As at last visit.
Stools.—One normal.
Vomiting.—None.
Appetite.—Leaves one to three ounces at a feeding.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	18 oz.	boiled	360 calories	Feed 5+ oz. every 3 hours, 7 feedings in 24 hours as before.
Water	18 oz.	boiled		
Dextri-maltose...	½ oz.		60 calories	

420 calories, or 45− calories per pound.

The sugar had to be cut down again and the number of calories diminished on account of the loss of appetite at this date.

March 20 (4 days later): Weight, 9 lb. 7 oz.

Gain 1 ounce only, on account of the low caloric value of the food.

General Condition.—As at last visit.
Stools.—One or two normal.
Vomiting.—None.
Appetite.—Good; takes all the food.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	18 oz.	boiled	360 calories	Divide into 7 bottles. Feed 5+ oz. every 3 hours as before.
Water	18 oz.	boiled		
Dextri-maltose...	¾ oz.		90 calories	

450 calories, or 47+ calories per pound.

The appetite now being good, a small increase in sugar may be made.

March 27 (7 days later): Weight, 9 lb. 12 oz.
Gain, 5 oz.

General Condition.—As at the last visit.
Stools.—One or two normal.
Vomiting.—None.
Appetite.—Fair; leaves no food.
Sleep.—Good.
Treatment.—Food unchanged.

April 3 (7 days later): Weight, 10 lb.
Gain, 4 oz.

General Condition.—As at last visit.
Stools.—One normal.
Vomiting.—None.
Appetite.—Never really hungry enough to finish all the food.
Sleep.—Good.

This infant continued to gain at a slow rate. Whenever the food was increased too fast, the lack of appetite would return. Fortunately this illustrates a very small class of cases, for such infants are very unsatisfactory to feed and the progress is always slow. The author has found the appetite to remain poor throughout the second or even third year in some instances.

(3) **Smaller, emaciated infants who are too weak to take the food** are usually also wrongly fed. Inanition and sheer lack of strength is the greater part of the cause of poor appetite in these infants, although originally it may have been due to wrong feeding. Some of these infants will linger over a bottle for an hour, in spite of the efforts of mother or nurse to make them take the food. It will readily be seen that an infant who is nursed every two hours and takes an hour at the bottle will actually be nursing eight or ten hours out of the twenty-four. This is extremely fatiguing and harmful. In such cases it is necessary to use a nipple with a very large hole, so that the milk will flow freely. If it is not well taken in this way, it must be fed with a medicine dropper, so that it may get the food with the least effort.

As for the food itself, stop the sugar altogether for a short period and give the milk and water boiled, usually one-quarter milk and three-quarters water in this particular class of cases. One should guard against giving this dilute food without sugar too long lest the infant lose rapidly in weight. Twenty-four hours is as long as a very weak, emaciated infant can stand weak food without sugar. These small, poorly-nourished infants should be fed at two-hour intervals.

Strychnia is particularly effective when given to this class of infants, for it not only stimulates the appetite, but its general action as a tonic is very much needed. It has helped to tide many an infant over a serious crisis.

Feeding by gavage (see p. 371) is occasionally resorted to. An infant who cannot be made to eat by any of the above

Fig. 11.—The stomach tube for gavage.

methods must be fed with the stomach-tube, though such feedings should not be continued longer than are absolutely necessary. Give the feedings in this way for a few days and then try the bottle. If the infant will not suck the nipple then, feed with the tube a while longer and again try the bottle. If it is not taken, the tube feeding may be continued, but the bottle should be offered several times a day.

Case LI

(Illustrating lack of appetite and its treatment in feeble and emaciated infants)

June 1: Age, 2 months 2 weeks. Birth weight, 8 lb.
Present weight, 5 lb. 9 oz.

General Condition.—Extremely emaciated, feeble; had atelectasis at birth, some signs of which remain. Caloric needs, 65 calories per pound per day.

Stools.—One to three normal.

Vomiting.—None.

Appetite.—Leaves half the food.

Sleep.—Twenty-three out of twenty-four hours.

Temperature, 97.6° F.

Chief Complaint.—Poor appetite.

Previous Food.—Nestle's food and water mixture, fed two ounces every two hours, ten feedings in 24 hours.

Treatment.—Strychnia, gr. 1/300 every six hours before a feeding.

Food prescribed:

Milk	10 oz.	boiled	200 calories	Divide into 10 bottles. Feed 3 oz. every 2 hours, at 6, 8, 10, 12 A.M., 2, 4, 6, 8, 10 P.M., and 2 A.M.
Water	20 oz.	boiled		
Sugar	0			

36+ calories per pound.

June 3 (2 days later): Weight, 5 lb. 8 oz.
Loss, 1 oz.

General Condition.—As at last visit.

Stools.—One normal.

Vomiting.—None.

Appetite.—Good; takes all the food.

Sleep.—Excellent.

Treatment.—Food prescribed:

Milk	12 oz.	boiled	240 calories	Divide into 10 feedings. Feed 3 oz. every 2 hours as before.
Water	18 oz.	boiled		
Dextri-maltose.	1/8 oz.	(1/2 level tbsp.)	15 calories	

255 calories, 46 calories per pound.

June 6 (3 days later): Weight, 5 lb. 9 oz.
Gain, 1 oz.

General Condition.—The same.
Stools.—Two or three normal.
Vomiting.—None.
Appetite.—Good; takes all the food.
Sleep.—Cries two or three hours a day. (Was too weak to cry much before, and now the cry is of good import, as it indicates that the infant is hungry.)
Treatment.—Food prescribed:

Milk	14 oz.	boiled	280 calories	Feed 3 oz. every 2 hours, 10 feedings in 24 hours as before.
Water	16 oz.	boiled		
Dextri-maltose.	¼ oz.		30 calories	
			310 calories, 56 per pound.	

Increase the milk one ounce a day, decreasing the water the same amount until fifteen ounces of milk and fifteen ounces of water are given.

June 11 (5 days later): Weight, 5 lb. 15 oz.
Gain, 6 oz.

General Condition.—The same.
Stools.—Three normal.
Vomiting.—None.
Appetite.—Good.
Sleep.—Good.
Treatment.—Food prescribed:

Milk	15 oz.	boiled	300 calories	Divide into 10 bottles. Feed 3 oz. every 2 hours as before.
Water	15 oz.	boiled		
Dextri-maltose.	¼ oz.		30 calories	
			330 calories, or 55+ per pound.	

The sugar was unchanged at this date because there had been a gain in weight and because it was thought best to go slowly and not create any digestive disturbance, the caloric requirements now being nearly fulfilled.

June 15 (4 days later): Weight, 6 lb. 4 oz.
Gain, 5 oz.

General Condition.—Improved.
Stools.—Three or four normal.
Vomiting.—None.
Appetite.—Good.
Sleep.—Good.
Treatment.—Food prescribed:

Milk	16 oz.	boiled	320 calories	Divide into 10 bottles. Feed 3 oz. every 2 hours as before.
Water	16 oz.	boiled		
Dextri-maltose.	½ oz.		60 calories	
			380 calories, or 60 per pound.	

June 22 (7 days later): Weight, 6 lb. 10 oz.
Gain, 6 oz.

General Condition.—The same.
Stools.—One normal.
Vomiting.—None.
Appetite.—Good.
Sleep.—Good.

Treatment.—Food prescribed:

Milk .... 18 oz.	boiled	360 calories	Divide into 10 bottles. Feed 3 oz. every 2 hours as before.
Water .... 18 oz.	boiled		
Dextri-maltose. ¾ oz.		90 calories	
		450 calories, or 68 per pound.	

With this cautious increase in sugar, which was eventually supplemented with a gradual increase in the strength of the food, this infant continued to do well.

(4) **Sore Mouth or Throat.**—Many an infant refuses its food solely because the act of swallowing is painful. An ulceration or abrasion in the mucous membrane or even a severe stomatitis will often go unobserved unless a careful examination of the mouth and throat is made. Teething, when accompanied by much swelling and redness of the gums, is commonly the cause of poor appetite. Cleft palate and other congenital anomalies of the mouth and throat must not be overlooked when new-born infants fail to suckle properly.

(5) **Infants Who Dislike the Taste of the Food.**—Many infants, especially after four or five months of age, become accustomed to certain tastes and therefore, refuse foods that taste differently. When sugar has to be omitted for any reason, add saccharine if the food is not well taken. Sometimes salting a milk and water mixture or omitting salt from a gruel formula, or adding cane sugar to a malt-sugar or lactose formula adds zest to the appetite. I have seen an infant whose food had been made with oatmeal gruel as a diluent refuse all foods till oatmeal was again used. Errors in technique such as incorrect posture while feeding, nipples where holes are too small or stopped up by improperly prepared food and ignorance of mother or nurse, should never be overlooked.

CHAPTER XVI

BREAST FEEDING

That mothers of the present day do not wish to nurse their infants and are anxious to avoid this duty is a mistaken idea. The author can think of only a few cases where a mother with a good supply of milk has been unwilling to nurse her baby. The majority of mothers are not only anxious to nurse their infants, but are extremely disappointed if they find that they have not milk enough to properly nourish them.

Whether a physical inability to supply proper breast milk is increasing among women in this country is a question which the general practitioner is in a better position to decide than the pediatrician. The latter is called upon to treat the infant who is not doing well, the result usually of the breast milk supply having failed. It is a peculiar fact, though, that many women of splendid physique have practically no breast milk even after repeated pregnancies, while small, frail women are frequently seen to have an abundant flow of milk with correspondingly robust infants.

Symptoms Indicative of Successful Breast Feeding

The following symptoms are usually indicative of successful breast feeding:

1. The infant gains six or eight ounces a week during the first six months, and after that from three to six ounces a week.

2. It falls asleep as soon as fed or while feeding and sleeps twenty hours out of every twenty-four up to the sixth month of age.

3. It does not cry more than one hour a day.

4. It has from one to three normal stools a day and no vomiting or gas.

FIG. 12.—The correct way to give a breast feeding.

Symptoms Indicative of Unsuccessful Breast Feeding

1. The infant loses in weight, ceases to gain or gains insufficiently.
2. Remains too long at the breast.
3. Cries or frets while nursing.
4. Cries when taken from the breast.
5. Has abnormal stools; and
6. Extreme vomiting, which can be definitely attributed to the breast milk.

Much has been said and written by pediatricians, and rightly so, concerning the importance of *continuing* the breast milk in every case where it is possible. The other side of the question, that of the advisability of discontinuing the breast, has been neglected. Every effort should be made to improve the breast milk and to keep the infant upon it, but it is equally important to know when to supplement the breast with the bottle or to discontinue breast feeding altogether.

Conditions under Which Breast Feedings Should be Continued Exclusively

1. Where the infant is normal and doing well upon the breast.
2. Where the infant is not doing well but the condition can be accounted for by errors in the management of the mother or infant, or by the health of the mother.

Under the second condition breast feeding should never be discontinued suddenly. It is advisable to keep the infant for at least one week exclusively upon the breast, properly regulating every detail. The weight should be taken at the beginning of this period, and if there has been found a fairly good gain in weight during this trial week it may not become necessary to institute bottle feedings.

During this period the following details should be carefully looked after:

1. Regulating the mother's diet.
2. Improving, if necessary, the mother's appetite.
3. Regulating the mother's bowels.
4. Regulating other hygienic details, such as exercise, sleep, and mental rest.
5. Remedying any actual disease of the mother, such as anæmia, etc.
6. Regulating feeding times and intervals.
7. Correcting any errors in detail of giving breast.
8. Remedying any defects in the hygienic surroundings or management of the infant.

Mother's Diet.—Of all these considerations, perhaps the most important is the diet of the mother, for without proper nourishment for herself she cannot nourish her infant.

It has never been definitely proved that any one kind of food that the mother eats increases any one element of the breast milk, either fat, sugar or protein, and it is an academic question, the importance of which is not of so much real consequence as knowing whether the milk as a *whole* can be improved by regulating the mother's diet. That breast milk can be improved in this way has been demonstrated by an immediate improvement and gain in weight shown in infants who were not doing well before a proper diet was instituted for the mother.

Many peculiar ideas about the diet of nursing mothers are found among the laity, and in each part of the country various notions obtain. For instance, along certain parts of the coast, fish is supposed to be most deadly both to the mother and infant during the nursing period. Almost universally vegetables and fruits are denied nursing mothers on account of possible injurious effects upon the infant. The vegetarian believes that no meat should be eaten during this period. All of these theories, however, have no foundation in fact and are harmful, in that they restrict the mother's diet at a time when she most needs nourishment.

There may be a few of the highly flavored fruits and vegetables that give rise to colic in the infant, but usually the absence of fruit and vegetables from the diet serves only to cause constipation in the mother and often in the infant. Meat is particularly beneficial in increasing the quality and quantity of the milk, and three hearty meals a day, with meat twice and eggs at the other meal, are advisable where an effort is being made to increase the breast milk supply. A diet that agrees best with both mother and infant during the nursing period is one to which she has become accustomed before pregnancy, provided it has been a proper and sensible one and did not cause indigestion.

An error common to physicians and the laity is that of giving too much milk or other fluids between meals. These fluids lessen the desire for the regular meals and should not be given to the exclusion of the three regular meals of the day. Case LI is a good illustration of this excessive fluid diet. In this case four quarts of malted milk were taken between meals, besides milk, milk soups, and other fluids at meal times.

Case LII

(Illustrating the effect of mother's overfeeding and its control)

March 8: Age, 5 months. Birth weight, 5 lb. 8 oz.
Present weight, 16 lb. 3 oz.
Gain since birth, 10 lb. 11 oz.

General Condition.—Excellent; fat, well developed, good color, skin smooth except for patches of eczema on the face and hands.

Stools.—Since birth two or three a day, sometimes green, watery, and with mucus.

Vomiting.—A few mouthfuls after each feeding.

Appetite.—Refuses breast at times.

Sleep.—Restless at night.

Temperature, 98.6° F.

Chief Complaint.—Has frequent *colic* and some *vomiting; cries* a great deal.

Previous Food.—Breast milk exclusively. Fed every three or three and a half hours, seven feedings in twenty-four hours. No regular intervals of nursing. *Mother eats three hearty meals a day, beside cream soups, tea and cocoa, and four quarts of malted milk between meals.* With this

forced diet she has increased her own weight since the birth of the infant from 105 pounds to 145 pounds.

Treatment.—(For mother.) Stop all liquids between meals except water. Eat three hearty meals a day, but no more than the appetite demands. (For infant.) Feed every four hours at 6, 10 A.M., and 2, 6, 10 P.M.

March 22 (2 weeks later): Weight, 16 lb. 8 oz.
Gain, 5 oz.

General Condition.—The same, except that the eczema has disappeared.
Stools.—*One yellow, normal stool with no mucus.*
Vomiting.—None.
Appetite.—Nurses well for ten minutes.
Sleep.—From 6 P.M. to 6 A.M., an hour in the morning and two hours in the afternoon.

This infant continued to do well, and, although it did not increase its weight rapidly (which, on the whole, was an advantage), it had much less indigestion and slept much better after the mother's diet was reduced.

If the appetite is good at the three regular meals, and if the mother also feels the need of nourishment during the interval, she may take a cup of some fluid nourishment between breakfast and luncheon, in the middle of the afternoon, and before retiring at night, but this should be discontinued when it is seen to interfere with the regular meals.

In obtaining a history of the diet it is well to review the events of the present day, asking the following questions: What did you eat for breakfast? What did you eat at the noon meal? What did you eat at night? What do you take between meals? How much milk or other fluids do you take in the twenty-four hours?

It is an American custom to take one very hearty meal a day, either in the evening or at noon, and to neglect the other two meals. Breakfast is apt to be light from habit or because of lack of appetite on rising in the morning; and in families where it is the custom to have the hearty meal at night to accommodate the father of the family, the busy

housewife very generally neglects her noonday meal. The result is underfeeding of the mother and, in many instances, of the infant. A mother should be impressed with the fact that for the infant's sake, if not for her own, she should eat a hearty breakfast and a proper meal at noon.

Case LIII

(Illustrating the effect of mother's underfeeding and its effect upon the infant)

October 11: Age, 6 weeks. Birth weight, 6 lb. 8 oz.
Present weight, 7 lb.
Gain since birth, 8 oz.

General Condition.—Small, poorly nourished, fretful.

Stools.—Two or three small, watery, yellow or green, some mucus, no curds.

Vomiting.—A little after each feeding.

Appetite.—Seems hungry all the time.

Sleep.—Poor, night and day.

Chief Complaint.—Has not gained in weight for the last three weeks. Cries most of the time.

Previous Food.—Breast-fed at irregular intervals, usually once in two hours, getting from two to four feedings at night and as many as twelve in twenty-four hours. The mother's bowels were normal and she was in her usual good health, but *had never been in the habit of eating more than a roll and a cup of coffee at breakfast,* and *at luncheon some soup and bread, with occasionally an egg.* She ate a good dinner, including soup, meat, and vegetables. *Nothing was taken between meals except a cup of tea or water.*

Treatment.—(For mother.) Food prescribed:

Breakfast: Cereal, one egg, bacon, toast.

Noon and night: A hearty meal, with meat and vegetables in plenty and a nourishing dessert.

10 A.M., 3 and 10 P.M.: Malted milk, milk, or cocoa. Nux vomica and gentian for appetite.

(For infant): Nursing from the breast only once in three hours at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.

October 16 (5 days later): Weight, 7 lb. 12 oz.
Gain, 12 oz.

General Condition.—Much improved.

Stools.—Two or three normal.

Vomiting.—Much less.

Appetite.—Good.

Sleep.—Good all night, but cries a great deal in the daytime.

The directions had been well carried out, the routine adhered to, and the mother was eating all the food prescribed. Treatment continued.

October 23 (7 days later): Weight, 8 lb. 4 oz.
Gain, 8 oz.

General Condition.—Excellent.
Stools.—Two normal a day.
Vomiting.—None.
Appetite.—Satisfied.
Sleep.—Most of the day and night.
Treatment.—With the exception of discontinuing the nux vomica, the treatment remained the same.

November 6 (14 days later): Weight, 9 lb. 11 oz.
Gain; 1 lb. 7 oz.

The infant continued to do well, and at six months of age was exceptionally fat, strong, and well, and still entirely breast-fed.

Such rapid improvement without the addition of bottle feedings is not to be expected in cases where the mother's milk is deficient when she is already taking the proper amount of nourishment.

An excellent diet for nursing mothers is as follows:

Breakfast.—A liberal dish of cereal, with plenty of milk and cream; one or two eggs (occasionally with bacon); toast or bread, and a cup of coffee or tea if the mother is in the habit of taking these beverages, otherwise cocoa.

Noon Meal.—A liberal piece of meat or fish; potatoes, baked, boiled, mashed, or creamed, and at least one other vegetable; a dessert of fruit, custard, a simple milk-and-egg pudding or ice cream.

Night Meal.—Soup (preferably a creamed soup); meat or fish; potatoes, baked, boiled, mashed, or creamed; other vegetables; salad; and a simple dessert, as at noon meal.

All indigestible food should be avoided, such as pastry, rich cakes, fried food, and excessive amounts of candy or sweets. A cup of malted milk, cow's milk, cocoa or a bowl of gruel (half milk) may be taken during the intervals. Any of the vegetables may be eaten, including cabbage, cauliflower, and turnips (particularly if the mother is constipated and needs laxative foods), provided they do not cause colic in the infant or indigestion in the mother.

Authorities differ greatly upon the subject of alcohol for nursing mothers. Personally the author does not advise its use as a means of stimulating the breasts to secrete more or better milk. In cases where some of the mild malt liquors have already been used by a mother and it has been demonstrated that they have not given the infant colic, their use need not necessarily be prohibited. The author recalls one case of a very abstemious woman who could temporarily stimulate her breasts to an abundant supply of milk by drinking one ounce of whiskey. She resorted to this expedient only on rare occasions when her milk had failed because she was overtired or not in her usual good health. She was permitted to use this method of stimulating the flow of milk on rare occasions, since it did not seem to cause any discomfort to the infant. There is no doubt that alcohol, taken by the mother, does give rise to indigestion in the infant, and in many infants colic was controlled after all alcoholic stimulation had been stopped. Many cases of colic are caused by a mother taking a cocktail or light wine or even beer for her dinner, and this, too, with a mother who had been accustomed to such moderate indulgence.

Mother's Appetite.—It is needless to say that a mother cannot take the food that is ordered for her unless she has a good appetite. When the appetite is poor it may usually be improved by remedying some error in her diet. This having been accomplished, it is usually well to prescribe a tonic. The one that the author has found most useful is:

℞ Tinct. Nux Vomica, ʒv
Tinct. Gentian Compound, q.s.a.d., ℥iv
Da Signa: 1 teaspoonful in a quarter of a glass of water three times a day before meals.

Mother's Bowels.—Many women get into the habit of taking cathartics during pregnancy or during the lying-in period, and a physician knows how difficult it is to overcome constipation of long standing, or constipation due to an

abuse of cathartics. It is highly important that every nursing mother should have at least one good evacuation of the bowels each day. Constipation in a breast-fed infant is more frequently due to constipation in the mother than to any other cause, and usually when the mother's constipation is overcome the infant's bowels become normal also. (See p. 294.)

There are three methods of overcoming constipation: dietetic measures, medicinal measures, and enemata. Dietetic measures should be tried before resorting to any others. It is not sufficient to tell a mother to eat plenty of fruit and vegetables and to take coarse food, because such general directions are apt to be misconstrued. It is necessary to tell her to take vegetables in plenty, both at her noon meal and at her night meal, and to lay particular emphasis upon the desirability of the coarser vegetables, such as beets, carrots, green corn, turnips, and cabbage. If it is seen that these vegetables cause colic in the infant, they must, of course, be discontinued and medicinal measures resorted to. She should also be told to take plenty of fruit. She should take fruits with every meal and often between meals, eating each day as many as three or four pears, apples, oranges, plums, or peaches (or other fruit in season), or as much as is necessary to make her bowels move. Prunes, raisins, and dried fruits may be taken, but one tires of them more easily than the fresh fruit and it is more difficult to take a sufficient quantity. The constipated mother should eat the coarser breads and cereals in preference to the finer ones. Oatmeal, graham bread, rye bread, bran biscuits are laxative.

Medicinal measures consist in the giving of a mild cathartic, consulting the mother as to her choice so far as is feasible. Salts of any kind should be avoided, as they result in watery movements which drain the body fluids and tend to dry up the milk. One of the many varieties of Russian oil (liquid albolin, etc.) may be taken once or twice a day after eating.

Phenolphthalein, 3 to 5 grains a day, may be used, usually giving 1 grain three times a day. Fluidextract of cascara, 10, 15, 20, or 25 drops three times a day before eating, may be used. The author prefers the phenolphthalein when it is necessary to give a cathartic. Enemata are useful while the nursing mother is still in bed, or to give the bowels the regular habit of evacuating, when the laxative diet is first being instituted. Either a plain saline enema or a glycerine and water enema may be used.

CASE LIV

(Illustrating constipation in an infant as a result of the mother's constipation—and its control)

December 17: Age, 5 weeks. Birth weight, 7 lb. 8 oz.
Present weight, 9 lb. 8 oz.
Gain since birth, 2 lb.

General Condition.—Fat, well nourished, normal infant.

Stools.—Constipated; bowels move once a day with enema.

Vomiting.—None.

Appetite.—Takes breast well for fifteen minutes.

Sleep.—Excellent.

Temperature, 98.6° F.

Chief Complaint.—Constipation; otherwise perfectly well.

Previous Food.—Breast milk exclusively, fed every three hours with great regularity (ten to twenty minutes at the breast), seven feedings in twenty-four hours. Mother's diet very good, except that she is not eating enough vegetables or fruits. Her appetite is excellent, but *her bowels are very constipated,* moving every other day with an enema.

Treatment.—(For mother) Advised to eat more and coarser vegetables, such as turnips, cabbage, beets, carrots, and at least two oranges and two apples a day between meals. These are to be discontinued if there are signs of the infant having colic or discomfort. If, after two or three days of this diet, the bowels did not move of their own accord, 15 drops of the fluidextract of cascara were to be taken three times a day before eating.

December 30 (13 days later): Weight, 10 lb. 6 oz.
Gain, 14 oz.

The mother's bowels moved freely once a day with the increased fruit and vegetables, so that she was not obliged to take the cathartic. This had a *decided effect upon the infant's bowels, which have moved once or twice a day.*

Exercise, Sleep, and Mental Quiet.—There are women whose milk supply is never satisfactory. Nervous, irritable women who are constantly worried are usually unable to

nurse their infants successfully. Try as one may, it is usually not possible to overcome a temperament of this sort, and, although the mother may be able to keep her infant on the breast for two or three months, the infant is not apt to thrive and usually has an attack of colic when anything happens to disturb the mother.

Case LV

(Illustrating effect of mother's nervousness upon her infant)

July 8: Age, 3 weeks. Birth weight, 8 lb. 11 oz.
Present weight, 8 lb. 13 oz.
Gain since birth, 2 oz.

General Condition.—Only fairly well nourished, good color, well developed.

Stools.—One or two per day, green, watery; much mucus and some fine curds.

Vomiting.—None.

Appetite.—Seems hungry all the time.

Sleep.—Cries a great deal throughout the day and sleeps only three hours at night.

Temperature, 99.4° F.

Chief Complaint.—Crying; not gaining in weight; loose stools.

Previous Food.—Breast-fed exclusively every three hours regularly, seven feedings in twenty-four hours; at the breast twenty minutes to half an hour at a time. The mother, who was under the care of a trained nurse, was on a model diet and eating plenty of good, nourishing food. Her bowels were kept in good condition; her milk seemed very plentiful, but was evidently causing the infant's loose stools. *She was exceedingly nervous* about her infant, worrying when there was no occasion to do so. She feared that it was going to die, and one of her chief dreads was that she would be the cause of its death by her inability to furnish proper breast milk.

Treatment.—(For mother) It was perfectly evident that this mother never could nurse her baby because of her nervous temperament. It was thought advisable, for a while at least, to allow the infant to be put to the mother's breast for only five minutes at a time to satisfy the mother.

(Treatment for the infant) Breast for five minutes only, every three hours, seven feedings in twenty-four hours, at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M., completing the feedings with 3 ounces of the following mixtures: milk, 7 ounces; water, 14 ounces; sugar, none; boiled and divided into seven feedings.

After two weeks, when the bottle feedings had been increased in strength and sugar added, the *breast was discontinued entirely* and the infant progressed normally on the bottle.

A mother who does not take enough exercise to keep herself in good condition cannot expect to have the proper milk for her infant. For such women the amount of exercise should be carefully planned in order that they shall not overtax their strength in endeavoring to fill the general directions of "more exercise." A woman who does not do her own housework may be advised to take the infant out in the carriage for a walk each day, sitting down whenever she becomes tired, and in that way be provided with an object for going out.

Many women do not have sufficient sleep, due, perhaps, to the infant's wakefulness at night. If the patient is wakeful at night, the mother should make up her lost sleep during the day. A physician should never be too busy to give his attention to these details if he expects to be successful with his feeding cases.

Remedying Any Actual Disease of the Mother.—Many women are weak and anæmic when they begin to nurse their infants following a difficult labor or a trying pregnancy. Often this fact is not taken into consideration by the physician, and the infant is abruptly taken from the breast when the mother's condition might have been improved and the infant allowed to remain upon the breast. A timely administration of an iron mixture will usually improve the anæmia and thereby increase the strength and save the breast milk. A neglected perineal wound, malposition of the uterus, or subinvolution is often the cause of the loss of the milk. It is often possible to save the breast milk even when it is necessary to do a major operation upon the mother. The author has seen women go through such operations as those for gall-stones and appendicitis and still retain their breast milk. The infant need be taken from the breast in some instances for only one day. If it is necessary to keep the infant away from the breast two or three days, the breast milk will not dry up, but will return as soon as the infant is again put to the breast. As a matter of fact, the author has seen

the breast milk return after the infant had been taken away for three weeks.

Regulation of Feeding Times and Intervals.—After many years of the two-hour interval plan for breast-fed infants it is now generally conceded that such intervals are never necessary except in extremely small, undersized, or premature infants. The average infant should be put to the breast once in three hours during the daytime and once at night from the first day of life to the end of the first year. For nursing babies the day begins at six in the morning and ends at nine or ten at night. The feedings are best given at a stated time each day, and it is well to write out the hours when the infant is to be fed. The hours of 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M., are usually most convenient, but 7, 10 A.M., 1, 4, 7, 10 P.M., and 2 A.M. may be used if they fit in better with the family times or other family routine. After three or four months of age, or possibly before, if the infant does it voluntarily, the 2 A.M. feeding should be omitted.

Four-hour intervals are preferable for normal, well-nourished infants who are gaining rapidly in weight. Large, robust infants whose mothers have a plentiful supply of good breast milk may be fed once in four hours from birth. Breast-fed infants who are vomiting or have colic or loose stools should be fed at four-hour intervals if they are gaining rapidly in weight. The usual hours are 6, 10 A.M., 2, 6, 10 P.M., and 2 A.M. It is always advisable to hold to the same hours each day and to waken the infant for the feeding during the first few weeks of life, when it first comes under treatment, so that it may establish habits of regularity, which it will very soon do with the proper training. It is not an uncommon experience to see an infant that is fretful and not sleeping properly, that is not gaining in weight or has digestive disturbances, such as vomiting and loose bowels, and where the whole fault lies in irregular feedings. A physician should be most insistent upon the matter of routine, as the whole success of his treatment may

rest upon it. He should also be emphatic enough in his instructions to impress the mother with the importance of following out his directions minutely.

CASE LVI

(Illustrating the effect of regularity of feeding in improving an infant's digestive disturbances)

December 29: Age, 2 months. Birth weight, unknown.
Present weight, 8 lb. 4 oz.

General Condition.—Well nourished, well developed, good color, normal in every way.

Stools.—One or two stools a day, green or yellow, watery, with some mucus and some curds.

Vomiting.—Two or three drams immediately after each feeding.

Appetite.—Nurses well five or ten minutes.

Sleep.—At short intervals only, except from 9 P.M. to 2 A.M.

Temperature, 98.8° F.

Chief Complaint.—Crying, vomiting, loose stools.

Previous Food.—Breast-fed exclusively (except for sugar and water feedings in the bottle); *fed whenever it cries.* Baby spoiled by mother, grandmother, and nurse. The mother's diet is excellent, her appetite good, and her bowels move once or twice each day.

Treatment.—(For mother) The mother was informed of the importance of *nursing the baby regularly,* and advised to take the infant away from the grandmother and to get a different nurse. Feedings were scheduled for 6, 9, 12 A.M., and 3, 6, 10 P.M.

These directions were carried out to the letter, evidently, for *the colic very quickly disappeared, the infant's bowels became normal, and the vomiting eventually ceased.*

Correcting Any Errors in Details of Giving Breast.—A physician may often discover mistakes that the mother is making, and occasionally very ridiculous ones, by watching the infant during a feeding. The author not long ago asked the mother of a breast-fed infant who was not doing well to nurse her infant so that he might see how it was done. The infant was six weeks old and the mother had been out of bed for three or four weeks. She promptly lay down upon the bed and, leaning over the infant, nursed it lying flat upon its back. This explained why the infant was getting the food too fast and was therefore vomiting it.

The length of time that an infant should remain at the

breast at each feeding, varies with the individual mother and the individual infant. This is a fact which is not sufficiently recognized. Many infants get all the milk they need in five or six minutes because the milk is abundant and flows too freely. If a mother with an abundant milk supply is told to nurse her infant for twenty minutes (the usual instructions) it is not only difficult for her to keep the infant awake for this length of time, but it will also cause the infant considerable indigestion. When the milk is less abundant and comes slowly the infant does need to be nursed for twenty minutes. The proper way is to nurse the infant until it stops of its own accord or perhaps goes to sleep (with a maximum of twenty minutes). If the infant has not received enough at one feeding, it will make up for it at the next.

Case LVII

(Illustrating the benefit of adjusting feeding details to suit the infant)

August 19: Age, 2 months. Birth weight, 6 lb. 8 oz.
Present weight, 10 lb. 9 oz.
Gain since birth, 4 lb. 1 oz.

General Condition.—Normal, healthy, well-nourished infant.

Stools.—Two or three daily, usually normal, but occasionally green and watery, with mucus.

Vomiting.—Occasionally a little.

Appetite.—Does not seem hungry.

Sleep.—Good at night, fair during the day.

Temperature, 98.6° F.

Chief Complaint.—Cries more than it should, seemingly with colic.

Previous Food.—Breast-fed exclusively with great regularity every three hours, seven feedings in twenty-four hours. *The mother, having been instructed to feed the infant for twenty minutes, has made every effort to keep it awake and nurse it for this length of time*, although it often seemed satisfied in five or six minutes, and was forced with difficulty to continue for the rest of the feeding time. The mother's diet and appetite were good and her bowels normal.

Treatment.—The infant to nurse at the same intervals as before (at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.), but only to take the breast until satisfied, even though this were but five minutes.

The colic and crying ceased almost immediately when these orders had been carried out. Usually the infant would nurse only for five minutes, occasionally for ten, and, as it gained the prescribed amount each week with these shorter nursings, it was evident that it got plenty of milk at this time.

Fig. 13.—Position in which to hold baby (head higher than breast) when milk flows too rapidly.

It is never advisable to nurse from more than one breast at a feeding except where two or more infants are nursing the same mother. The right and left breasts should be used alternately, as when both breasts are drained too often (both breasts once in three hours) the milk supply is apt to deteriorate. If the infant is not gaining in weight and is not satisfied with the milk it gets from one breast at a single feeding, it is better to supplement the breast with a bottle feeding.

The use of a nipple shield or the pumping of the breasts and feeding with a spoon or bottle, although very useful temporary expedients, should never be continued over any length of time. The act of sucking stimulates the breasts to secrete the proper quality and quantity of milk. In cases where the infant is too weak to nurse the breast, or shows no inclination to do so, the milk will soon deteriorate and the supply fail unless another infant can be used temporarily to stimulate the breasts in the natural way. Sore nipples or anything that makes the nursing painful have an unfavorable influence upon the breast milk. One occasionally sees an infant who has been nursing from a nipple shield for several weeks because in the beginning the nipples were sore or because they were inverted or small. It then becomes necessary to make the infant take the nipple without the shield, even though a day's starvation has to be resorted to.

Case LVIII

(Illustrating the effect of using a nipple shield)

December 10: Age, 4 weeks. Birth weight, 7 lb.
Present weight, 7 lb. 4 oz.
Gain since birth, 4 oz.

General Condition.—Fairly well nourished, but evidently underfed.
Stools.—One or two normal per day.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Poor.
Temperature.—98.6° F.
Chief Complaint.—Not gaining in weight; fretful.

Previous Food.—Breast-fed exclusively once in three hours, seven feedings in twenty-four hours. Owing to inverted nipples, nipple shields were ordered the first day or two of life. The infant had become accustomed to the large size of the nipple of the shield and would not take the mother's nipples, although they had been drawn out by the use of the shield. The supply of breast milk was evidently diminishing in spite of the fact that the mother's diet was correct and all other details were properly carried out.

Treatment.—It was advised to *abandon the nipple shield and put the infant directly to the breast.* Though the mother declared that this would be impossible, she was urged to persist for twenty-four hours, giving the infant no other food during that time.

These directions were carried out, and after about twelve hours' starvation the infant began to suckle properly. This stimulated the breasts so that *the milk was increased in quantity* with remarkable rapidity and the supply was ample for the infant for several months.

Corsets should be of the correct height, so that the edge will not strike the breasts. They should be either high enough to come above the breasts or low enough to come entirely below them. A very good nursing corset is made, which entirely covers the breasts with soft material and opens at the nipple line, so that the whole breast may be exposed at the time of nursing. Corsets which rub upon the breasts not only make them sore but are a frequent cause of breast abscesses.

The position of the infant while nursing should be a semi-reclining one, with the mother sitting in a comfortable chair in the erect position, the infant lying upon her arm. If it is found that the infant gets the milk too fast, the mother may sit in a chair with very high arms, or beside a table. In this way she may rest her arm high, so that, as the infant lies upon it, its head is higher than the breast and it is obliged to pull upward upon the nipple. Milk that comes too fast will often be found to run out in a stream when the breast is hanging down and the infant is pulling at it.

Remedying Defects in the Hygienic Surroundings or Management of the Infant.—An infant should have plenty of fresh air, be properly clothed, and made comfortable in every way, and it is part of the physician's duty, when supervising its feed-

ing, to see that these details are carried out. An infant will often sleep outdoors when its sleep is broken and interrupted in the house, and a plentiful supply of cool air in the chamber at night is also conducive to sound sleeping. A tight belly-band is extremely uncomfortable, especially when it slips up under the arms, and should be discontinued after six weeks of age and a knitted band with straps over the shoulders substituted for it. Too much handling is very bad for the infant, and during the first five or six months of life an infant should be kept in its crib or carriage twenty-two hours out of every twenty-four, being taken up only for its bath and feedings. Many an infant's indigestion is caused by its being taken into the mother's bed at night. The mother, being half asleep, does not notice when the infant is nursing (after she has become accustomed to it), and a habit of sucking most of the night is easily formed.

Examination of Breast Milk

The best indication of the quality of the breast milk is the condition of the infant who has been nursing that breast. If the infant is fat and well nourished, has solid flesh and well-formed bones, and is gaining progressively in weight, one may be satisfied that the breast milk is of a good quality. If the infant is not doing well, which is the usual reason for wishing to know the quality of the milk, it is doubtless an indication that the milk is poor in quality or quantity.

Every mother who is at all troubled about the condition of her infant wishes her breast milk examined. An examination of the milk itself is of less value than an inspection of the infant. If breast milk is examined at all it should be examined by a competent chemist in a well-equipped laboratory. The quantity of sugar, fat, protein, salts, and total solids should be determined. The usual examinations made by the physician, which are unavoidably meagre, are of very little service. The pyoscope, an instrument which is sup-

posed to estimate the amount of fat by the color of the milk, the color being compared with a graduated color disc, is not accurate enough to be of any service. It is a well-known fact that the color of cow's milk varies with the season, the variety of food taken, and the breed of cow, and the color of breast milk also varies under varying conditions.

A common error in the examination of breast milk is in taking too small a portion of it for examination. A case is recalled of a woman who brought to the hospital her infant who was not doing well. An examination of her milk was ordered, and specimens were obtained on two different days. The first day a small amount of milk was taken from the breast before the infant had nursed, which consisted, therefore, of the foremilk. A few days later the milk was taken from the breast after the infant had nursed, this specimen containing the rich "strippings." One can readily imagine the enormous difference in the reports of these two specimens of the same mother's milk. The first was so poor that the mother was advised to institute bottle feedings at once, while the second was so high in fat as to cause the opinion that it was the root of all the infant's digestive disturbances, and the mother was advised to cut down her diet and shorten the infant's nursings and to dilute her milk by giving water before and after the feedings. This case is illustrative of the absurdities which occur in the examination of breast milk.

It is a question whether a fair sample of breast milk is ever procured by artificial means, especially where the milk supply is a limited one. Theoretically it would seem as if a fair average might be struck if the whole breast were emptied, but it is doubtful if the breast milk that is milked out or taken with the breast-pump is ever a fair sample of that secreted during the natural process of nursing with the infant's lips to the nipples.

The author seldom finds it necessary to have the milk examined, usually being able to determine the quality by the progress made by the infant.

Breast Feeding of New-born Infants

The sucess of breast feeding depends largely upon its being properly begun in the early days of life. Occasionally injurious practices are instituted by physicians as well as by the laity, that interfere with successful breast feeding. Chief among these is the custom of giving water, sugar and water, barley gruel and various milk mixtures or any other foods during the first days of life. This is most often done because the breasts are not secreting milk and it is imagined that the infant is hungry.

The argument is advanced by those in favor of its administration that water and sugar are needed to prevent loss in weight during the first two or three days of life, when there is not sufficient fluid in the breasts, and the body fluids of the infant are being drained off through the kidneys and bowels. Another argument advanced for its use is that the sugar acts as a laxative upon the bowels. In theory these arguments would seem reasonable, but as a matter of fact the giving of sugar and water does not prevent the loss of weight, the bowels usually move thoroughly of their own accord, and great harm is frequently done by giving water and sugar, or water alone, as it prevents the infant from taking hold of the breast properly when it is time for it to do so. The stomach being filled with water, the infant feels no need of food, and when put to the breast makes no attempt to suckle.

The infant's refusal to take the breast during the first three days of life is one of the most trying conditions with which we have to deal. The mother becomes tired and upset, her condition acts unfavorably upon her milk, and mother, infant, and physician are disturbed as a result.

The more an infant cries the more water it gets from the bottle and the less willing it is to take the breast, especially if the nipples are small, having become accustomed to the larger nipple used on the bottle. The sugar which is given as a laxative upsets the gastric and intestinal digestion, vomiting occurs, and the stools become loose. Had nature intended an infant to have other than the colostrum during the first two or three days of life she would have assuredly provided it.

An infant should be put to the breast from four to six hours after birth and every four hours thereafter until the second or third day, when the three-hour schedule should be instituted, feeding the infant seven times in twenty-four hours, at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M. The breasts are stimulated by the infant's mouth at the nipple, and obstetricians assert that proper contractions of the uterus are brought about by the act of nursing. Habits of regularity are established early, and a plentiful amount of sleep for the infant insured, with rest and quiet for the mother.

It is not advisable to give any active cathartics or salts to the mother during the early days of the infant's life. Salts are particularly harmful, as they tend to dry up the milk.

As soon as the infant has learned to take the breast well and is nursing vigorously, *unsweetened* water may be given after a nursing if the infant cries and if there seems to be insufficient colostrum secreted by the breasts. Sugar and water should never be given; in fact, even if the breasts were to fail entirely and the infant had to be put upon the bottle, the sugar is best omitted from the bottle feedings for the first few days.

On the second or third day the breasts become distended and the milk comes in very quickly. If there is no milk by the beginning of the fourth day, the breast remaining flat and empty, bottle feedings should be begun at once.

A most objectionable custom is the giving of a dose of calomel to new-born infants because of excessive crying, thin mucous stools, or jaundice. It is assumed that the infant has colic, and the universal panacea for colic is calomel. The chances are equal, however, that the crying is due to hunger or discomfort from some other source. The stools of a new-born infant are almost always, as soon as the meconium has disappeared, thin and watery and contain mucus and a few fine curds. They may be green even in an infant making a normal progress. Jaundice occurs in at least one-third of all new-born infants. It comes on from the third to the fifth day of life, and is rarely seen the first day or seldom known to appear after the sixth day. The average duration of mild cases is from three to four days. In severe cases it may last from one to two weeks. The causes of jaundice are varied. In its simple form it is supposed to be due to a too active secretion of bile soon after birth, resulting in an overflow into the lymph and blood-vessels. More severe cases are due to a pyogenic infection, congenital malformation of the bile-duct, or interstitial hepatitis. Calomel is not indicated in the jaundice of new-born infants.

Indigestion in Nursing Infants Who are Gaining Well in Weight

There is a class of infants who, although they are gaining progressively in weight, cry a great deal, expel a great deal of gas, and perhaps have a green stool now and then. It is almost criminal to take such infants off the breast, although the temptation to do so is very great, because of the worry they cause the mother and the consequent harassing of the physician. Such an infant will frequently cry for six, eight, ten, or twelve hours out of the twenty-four, and still make a good gain in weight each week, in which case it is very probable that the infant is being overfed and the food supply should be reduced.

There are two ways of diminishing an infant's food supply: First, by limiting the mother's diet, and, second, by shortening the length of the feeding time. If the mother is drinking large quantities of liquid nourishment either between meals or with her meals, this should be stopped or limited to a small amount. Beside this, solid food may be restricted to a certain extent, stopping, particularly, the richer foods, such as sweets and pastry. Alcohol should be prohibited. Highly-flavored fruits and vegetables and highly-seasoned food may give rise to harmful substances in the milk and should be temporarily eliminated from the diet. The writer would include among these highly-flavored and seasoned foods asparagus, cabbage, cauliflower, turnips, Brussels sprouts, peppers, parsnips, and all vegetables eaten raw, such as cucumbers, radishes, lettuce, and onions.

The second method, that of cutting down the food supply by means of shortening the feedings, should only be used with infants who are gaining very rapidly (over eight ounces a week). The infant should be fed once in three hours from 6 A.M. to 10 P.M., and if possible the 2 A.M. feeding should be omitted. The feedings should at first be limited to five minutes, gradually increasing this length of time as the infant's symptoms improve. The same object is attained by lengthening the interval to four hours, feeding the infant for twenty minutes at 6, 10 A.M., 2, 6, 10 P.M. If there is no improvement in the symptoms and the infant does not gain normally in weight under such treatment, it is advisable gradually to increase the mother's diet again without excesses and to return to the longer nursings or the shorter intervals, giving enough to satisfy the infant at each feeding.

The futility of medicinal treatment such as pepsin and the other digestive ferments is perfectly evident to those of open minds who have tried them. Mothers will usually implore a physician to give some medication to stop the cry-

ing, but if he does so in order to pacify the mother he must realize that he is not helping the condition, and must be careful not to give such medication as syrupy mixtures or opiates, that would be harmful to the infant.

Vitamin deficiency in breast milk is seldom seen in this country where most nursing mothers have a varied diet plentifully supplied with fats, green vegetables, milk, eggs, meat and coarse cereals which have not been robbed of their vitamin content. In Denmark where butter and milk fats are often lacking in the diets of the poor, the deficiency in vitamin "A" often leads to xerophthalmia or chronic inflammation of the eye lids, conjunctiva and sclera and finally blindness. In the far East a diet of polished rice and fish makes Beri-beri so common a disease among nursing mothers that the mortality of the breast-fed is said to exceed that of the bottle-fed in certain districts, due to the deficiency in Water Soluble B. In this country where rickets is our scourge it is evident that the accessory food factor D. is a dietary deficiency of many pregnant women and nursing mothers. Since cod-liver oil supplies this vitamin in abundance it should be administered to pregnant women who bear rachitic infants and nursing mothers whose babies have rickets. Sunshine and Alpine ray or foods activated by the ray may also be utilized. It is only in this way that we may hope to avoid rickets. Any mother whose infant has developed rickets in utero or while nursing her babe should receive this treatment in subsequent pregnancies.

CHAPTER XVII

COMBINED BREAST AND BOTTLE FEEDING

Indications for Complementing the Breast with Artificial Feedings

When everything possible has been done to improve the quality and quantity of the breast milk (see Chapter XVI) and there is still an insufficient gain in weight or the infant cries a great deal with hunger, it becomes necessary to add bottle feedings. How long a trial should be made before starting the bottle must depend upon the gain in weight and the extent of the general improvement during the first trial week. A breast-fed infant who is doing well should gain six or eight ounces a week during the first six months of life. Where an infant has not gained before being brought for treatment, and a three- or four-ounce gain is made during the first trial week, with a general improvement in all of the symptoms, we may reasonably expect a still greater improvement during the second week, and accordingly delay the bottle feedings for another week.

Where an infant has gained slowly before coming for treatment (two to four ounces a week over a period of at least four or five weeks), and if no greater gain is shown during the trial week, the complemental feedings should be instituted at once. Where an infant has not improved at all or has made no appreciable gain in weight during the first trial week, there is no indication for delaying the bottle feedings longer. When, from the emaciated condition of the infant, it is evident at first sight that the milk is extremely deficient, a trial week is not necessary and bottle feedings must be instituted at once. This is particularly indicated in cases where the mother's diet has been correct, the hours of feeding have been fairly regular, and the principal details carefully carried out as indicated in the previous

chapter. Case LIX shows this very nicely, it being evident at the first visit that complemental feedings must at once be instituted.

Case LIX

(Illustrating the immediate necessity of complemental feedings for emaciation)

April 29: Age, 2 months 2 weeks. Birth weight, 5 lb. 6 oz.
Present weight, 6 lb.
Gain since birth, 10 oz.

General Condition.—Pale, extremely emaciated, undersized, feeble cry.
Stools.—One small, watery stool with mucus (from underfeeding).
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Poor; cries most the day and night. t.
Temperature, 97° F.
Chief Complaint.—Emaciation, crying.
Previous Food.—Breast-fed exclusively every two and a half hours, seven or eight feedings in twenty-four hours. Stays at breast half an hour or longer. *Mother's diet is correct, her appetite good, and her bowels normal.*
Treatment.—Give seven feedings from the breast, of ten minutes each, completing each feeding with 3 ounces from the bottle, using the following formula:

Milk	7 oz.	boiled	Divide into 7 bottles. Feed at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water	14 oz.	boiled	
Sugar	0		

Each day increase the milk one ounce, allowing the amount of water to remain the same until the formula is:

Milk	14 oz.	boiled
Water	14 oz.	boiled
Sugar	0	

May 6 (7 days later): Weight, 6 lb. 8 oz.
Gain, 8 oz.

General Condition.—Slightly improved.
Stools.—One constipated, with enema.
Vomiting.—None.
Appetite.—Good; takes all the food.
Sleep.—Good at night, restless during the day.
Treatment.—Food prescribed:

Milk	14 oz.	boiled	Divide into 7 feedings of 4-ounces each. Feed at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M. *after each ten-minute breast feeding.*
Water	14 oz.	boiled	
Sugar	0		

May 15 (9 days later): Weight, 7 lb. 3 oz.
Gain, 11 oz.

General Condition.—Greatly improved.
Stools.—One constipated.
Vomiting.—None.
Appetite.—Good; leaves no food.
Sleep.—Good.
Treatment.—Food prescribed: as above.

The infant was gaining so rapidly that it was not thought best to increase the food. Reckoning calories would not help us, because it was not known how many calories the breast milk contained. The infant's caloric needs are 420 (7×60), though it is *known* to be getting from the above formula only 280 calories.

The breast milk was continued throughout the summer. The artificial feedings were gradually increased and sugar added, and on September 21 the infant weighed 14 pounds 9 ounces.

When the breast milk is deficient, it is generally advisable to give an infant all the breast milk that there is, as a little breast milk is better than none and helps digest an artificial feeding when the two are given together.

There is always the possibility, of course, of an infant's voluntarily giving up the breast for the bottle once the bottle feedings are instituted, the infant in many instances preferring the bottle to the breast. This difficulty may be obviated to a certain extent by putting no sugar in the bottle feedings and by using the complemental instead of the supplemental feedings.

By *supplemental feedings* we mean entire breast feedings at certain hours, alternating with entire bottle feedings at other hours. With *complemental feedings,* each breast feeding is complemented or made complete with a bottle feeding given immediately after.

The author has tried both methods thoroughly and is heartily in favor of complemental feedings (combining bottle and breast at each feeding), except in cases where it is intended to wean the infant from the breast. With complemental feedings

1. The infant does not neglect the breast so readily and wean itself.

2. The infant is evenly fed, not being underfed at one feeding and overfed at another.

3. The breasts are stimulated by being emptied at regular intervals, not too far apart. Too long intervals between breast feedings will cause the breast milk to deteriorate.

CASE LX

(Illustrating complemental feedings for underfeeding)

May 16: Age, 4 months. Birth weight, 7 lb. 8 oz.
Present weight, 11 lb. 8 oz.
Gain since birth, 4 lb.

General Condition.—Poorly nourished, well developed, pale.

Stools.—One constipated, yellow, per day, no mucus or curds.

Vomiting.—None.

Appetite.—Seems hungry all the time.

Sleep.—Good.

Temperature, 98.6° F.

Chief Complaint.—Not gaining properly in weight for the last two months.

Previous Food.—Breast-fed exclusively once in three hours, five feedings in twenty-four hours. Mother's diet excellent and her appetite and bowels normal.

Treatment.—Advised to nurse only ten minutes from the breast every three hours at 6, 9, 12 A.M. and 3, 6, 10 P.M., six feedings in twenty-four hours, each breast feeding to be completed by a bottle containing the following formula (divided into six portions):

Milk .... 10 oz. } boiled
Water .... 20 oz. }
Cane sugar .... ¼ oz.

Increase the milk one ounce each day, keeping the amount of water constant, up to half milk and half water.

May 27 (11 days later): Weight, 12 lb. 8 oz.
Gain, 1 lb.

General Condition.—Much improved.

Stools.—One normal a day.

Vomiting.—None.

Appetite.—Still hungry.

Sleep.—Excellent.

Treatment.—Food prescribed:

Milk .... 20 oz. } boiled
Water .... 20 oz. }
Cane sugar ..... ½ oz.

Divide into six feedings of 7– ounces each. Feed every three hours at 6, 9, 12 A.M. and 3, 6, 10 P.M. *To complete each ten-minute breast feeding.*

The milk and sugar were gradually increased, and on September 16 the infant weighed 18 pounds.

In giving directions for a complemental feeding, the physician should instruct the mother to prepare the required number of bottles every day according to the directions given in the chapter on "Bottle Feeding." Before beginning the nursing the bottle should be warmed, ready to give immediately after the breast feeding is finished. The length of time that the infant should be allowed to remain at the breast before giving it the feeding from the bottle varies with the quantity of milk the breast is secreting. Usually the mother is able to tell when the breast is empty by the pulling sensation felt when the infant is sucking upon an empty breast or by the fact that the infant becomes restless and refuses to nurse. It is seldom advisable to give the breast for more than ten minutes when complemental feedings are used, and five minutes is usually all that is necessary. Only one breast should ever be given at a feeding when the complemental feedings are used. Three-hour intervals between feedings are usually advisable, at 6, 9, 12 A.M. and 3, 6, 10 P.M. Until the infant is four or five months of age a 2 A.M. feeding may be given, and this entirely from the breast, as it will usually secrete enough to satisfy the infant until the morning feeding, thus obviating the necessity of the mother's getting up in the night to warm the bottle.

Gauging the Strength of the Food.—In deciding upon the food to give with breast milk it is not practicable to reckon the amount in calories, the exact number of calories in the breast milk taken in twenty-four hours not being known. For a week or two it is advisable to begin with one-third milk and two-thirds water, without sugar, boiling the milk and water together. If this is well borne during the first week and there is a gain in weight, the milk can be increased one ounce at a time until half milk and half water are given during the second week. This increase may be advisable during the first week in cases where the breast milk is very deficient.

It is usually unnecessary to put sugar into the food during the first week, but it may be added during the second week if there has not been a sufficient gain in weight and provided the infant's stools are not loose and there is no excessive vomiting. On the other hand, sugar is often unnecessary for a number of weeks when the breast milk is fairly good and if there is a good normal gain of six or eight ounces each week without it. Some breast milks are found to be very rich in sugar, even though poor in fat and protein, in which case there is sugar enough in the breast milk itself to make it unnecessary to add artificial sugar to the food. When it becomes necessary to add sugar, as shown by an insufficient gain in weight or pronounced constipation, it is well to begin with one-quarter of an ounce in twenty-four hours and gradually increase this to one or one and a half ounces. Cane Sugar may be added to sweeten the food wherever an infant needing complimental feedings refuses the bottle, provided the stools are not loose or provided there is no other contra indication. The quantity of bottle feeding is often a problem, as the quantity of the breast milk taken cannot be accurately measured. A good plan is to make up enough food so that the infant may have after each breast feeding as many ounces of artificial food as it is months of age. If all of this is not taken, no harm is done.

The baby may be weighed before and after each breast feeding and the difference in weight will give the amount of breast milk consumed. Even if this is done it is not always a definite guide as to the exact amount of bottle food needed. The author does not approve of continuing this weighing process over a long period since the best guide to the infant's needs is the appetite together with the gain in weight, vomiting, sleep and stools.

CHAPTER XVIII

CONTRA-INDICATIONS FOR BREAST FEEDING

It is usually wise to make an attempt to nurse the infant during the first week of life, no matter how discouraging the outlook may be. The breast must never be discontinued where it is in any way possible to avoid it.

There are seven contra-indications for breast feeding:

1. Where the infant has severe prolonged gastric or intestinal indigestion associated with loss in weight or cessation of gain.

2. When at two previous births the mother has been unsuccessful in nursing the infant under the proper conditions and intelligent care.

3. Where the mother has puerperal convulsions.

4. Where the mother is pregnant.

5. Where the mother has some prolonged acute infectious disease, as typhoid fever or pneumonia.

6. Where the mother has tuberculosis (pulmonary or localized elsewhere), epilepsy, nephritis, any malignant disease, primary anæmia or severe secondary anæmia, or where the mother or the infant has contracted syphilis after the infant's birth.

7. Infants over one year of age.

Severe Prolonged Gastric and Intestinal Indigestion.—Occasionally a breast milk is injurious and harmful and the cause of severe gastric and intestinal indigestion. Such instances are few in number, it being the rule, with few exceptions, that a little breast milk is better than none. But even in these cases, before discontinuing the breast it is well to see whether a correction of the diet and a proper regulation of the various details of breast feeding will not make

it unnecessary to stop the breast feeding. If, after these errors are rectified, the infant continues to vomit and does not gain, or is losing in weight, and we are convinced that the vomiting is caused by the breast milk, the breast may be abruptly stopped. In the same way, if there is evidence that severe intestinal indigestion is caused by the breast milk, the same holds true. We must remember, though, that underfeeding may also cause loose, watery, green, or mucous stools, in which case complementing the breast with a proper bottle feeding will bring about normal stools, and the breast feedings need not be discontinued. We should also assure ourselves that the vomiting is not due to some organic disease such as pyloric stenosis, in which case the condition is aggravated by a discontinuance of the breast feedings.

Case LXI

(Illustrating severe vomiting caused by breast milk, and eventually remedied by stopping the breast feedings)

October 26: Age, 3 months 1 week. Birth weight, 5 lb. 8 oz.
Present weight, 10 lb.
Gain since birth, 4 lb. 8 oz.

General Condition.—Fairly well nourished, well developed.

Stools.—Constipated, one each day with enema.

Vomiting.—Excessive, "the larger part of the food taken after almost every nursing"; continues right up to time of next feeding.

Sleep.—Good during the day, poor at night.

Appetite.—Good; nurses ten to fifteen minutes.

Temperature, 98.6° F.

Chief Complaint.—Vomiting, constipation.

Previous Food.—Exclusively breast-fed once in two or three hours and two or three times in the night, making in all eight or nine feedings in twenty-four hours. The mother eats three hearty meals a day and drinks, besides, two quarts of milk. Her appetite is fair (she forces herself to eat) and she is constipated, requiring an enema each day.

Treatment.—(For the mother) Stop milk between meals; take instead malted milk if hungry. Eat plenty of fruit and vegetables for the constipation. Nux vomica and gentian prescribed. (For the infant) Nurse every three hours, at 6, 9, 12 A.M., and 3, 6, 10 P.M., six feedings in twenty-four hours. Nurse for five minutes only until after the third day, when the time may gradually be increased to ten minutes.

The vomiting was extreme, but was not projectile in character. There was no visible peristalsis of the stomach. The infant had gained fairly well in weight. Its stools were large, showing that a good deal of food passed through the pylorus, and it was therefore concluded that there was no pyloric stenosis or even pyloric spasm.

November 2 (7 days later): Weight, 10 lb.
No gain, no loss.

General Condition.—The same.
Stools.—Still somewhat constipated.
Vomiting.—Not at all improved.
Appetite.—Hungry.
Sleep.—Poor.

Treatment.—Nurse at breast for five minutes every three hours as above, completing each feeding with three (gradually increased to four) ounces of the following formula:

Milk .... 6 oz.
Water......... 12 oz. } boiled and divided into six portions.
Sugar 0

Each day increase the milk one ounce, allowing the quantity of water to remain stationary.

November 9 (7 days later): Weight, 10 lb. 4 oz.
Gain, 4 oz.

General Condition.—The same.
Stools.—One constipated with enema.
Vomiting.—Still excessive.
Appetite.—Ravenous.
Sleep.—Poor.

Treatment.—Food prescribed:

Milk......... 12 oz.
Water........ 12 oz. } boiled
Sugar........ 0

Divide into six bottles of four ounces each. Feed after each ten-minute feeding at the breast at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.

November 16 (7 days later): Weight, 10 lb. 6 oz.
Gain, 2 oz.

General Condition.—The same.
Stools.—One or two normal.
Vomiting.—Worse than at last visit.
Appetite.—Very hungry.
Sleep.—Poor.

The gain in weight was unsatisfactory, and, as there was no improvement in the vomiting, it was decided to stop the breast milk, which was considered the cause of the disturbance.

Treatment.—Discontinue the breast milk and give

Milk	18 oz.	boiled	Divide into six feedings. Feed six ounces at 6, 9, 12 A.M., 3, 6, 10 P.M.
Water..........	18 oz.	boiled	
Dextri-maltose...	1/4 oz.		

(Increase a teaspoonful at a time to 1 oz.)

November 23 (7 days later): Weight, 10 lb. 11 oz.
Gain, 5 oz.

General Condition.—The same.

Stools.—One or two normal.

Vomiting.—*Greatly improved; regurgitates only a mouthful now and then.*

Appetite.—Hungry.

Sleep.—Improved.

As soon as the milk and sugar were increased to a quantity sufficient to fulfil the infant's caloric requirements, a steady and progressive gain in weight was made without any return of the vomiting, showing that the vomiting was due to the breast milk.

Two Previous Unsuccessful Attempts to Nurse.—Where a mother, during her previous pregnancies, has had careful supervision and intelligent care, and every effort has failed to increase the supply of breast milk after the births of two previous infants, there is almost sure to be no milk for the third infant. It has been the author's observation that the milk is far more apt to diminish in quantity with each succeeding birth than it is to increase, and he considers it unwise, therefore, to weaken the infant with a vain attempt to supply it with breast milk when the chances of success are so slight. New-born infants are usually easier to feed from the bottle than older infants, whose digestive power has been lessened by unsuccessful feeding.

Puerperal Convulsions.—It is a disputed question whether or not toxic bodies are secreted in the milk of eclamptic mothers, but it would seem to be a common-sense view of the subject not to allow a mother to nurse her infant after a severe eclampsia. There are certain cases of eclampsia, mild in character, in which the mother's improvement is so rapid after the birth of the infant that within a week's time there may be no danger in putting it to the breast. It is, however, safer not to use the breast milk for a week at least,

and not at all if the mother has not entirely recovered by that time.

Pregnancy.—There can be no argument in favor of a pregnant woman nursing her infant. Nature never intended one individual to furnish adequate nutriment to an infant in the uterus and one at the breast at the same time. In cases where an attempt has been made to do so, the milk has been found to have greatly deteriorated and nursing has proved harmful to embryo, mother, and infant. In some parts of the country there is an idea among the laity that the breast milk of a pregnant woman contains poisonous substances which are actually injurious to the nursing infant. Whether this is so or not has never been definitely proved, but it is possible that in certain toxæmias of pregnancy harmful bodies may be secreted by the breast and transmitted to the nursing infant.

Acute Infectious Diseases.—In some of the acute infectious diseases lasting less than a week the infant may be temporarily taken away from the breast, as explained in the section on "Temporary Discontinuation of the Breast," but in prolonged and severe diseases of any kind the breast should be permanently discontinued for the welfare of both the mother and the infant.

Tuberculosis and Other Chronic Diseases.—A tuberculous mother should never be allowed to nurse her infant, not only because of the danger to the infant by contact with her and through the milk itself, but also because of the extremely debilitating effect upon the mother and the unfavorable progress of the disease when the added burden of nursing an infant is put upon her. This applies to any form of tuberculosis.

Epilepsy, anæmia, and nephritis are also contra-indications for the same reasons.

Congenital syphilis is not a contra-indication for breast feeding. It is now a well-known fact that there is no such

thing as a non-syphilitic mother of an infant with congenital syphilis, for, although the mother may never have had any visible signs of syphilis, she will, in the majority of instances, show a positive Wassermann reaction. The danger, therefore, of the infant's infecting the mother is eliminated and the infant's chances of recovery are greatly advanced by the breast feeding, and, except in very severe cases of congenital syphilis, we are usually able to make a favorable prognosis as to life when the breast milk supply is abundant. Syphilis acquired either in the mother or the infant after birth is, however, a strong contra-indication to breast feeding in order that the one may not infect the other.

Conditions under Which the Breast Should be Temporarily Discontinued

1. During an acute, though perhaps brief, illness of the mother.
2. In selected cases, during menstruation.
3. In some cases of acute diarrhœa in the infant.
4. In some cases of acute vomiting in the infant.

During an Acute Illness of the Mother.—During any acute febrile disturbance, where the temperature runs above 101° or 102°, it is well to stop the breast temporarily. It may not be possible at the beginning to diagnose the disease from which the mother is suffering, and it is always safer to stop the breast milk for a period of from twelve to twenty-four hours at least, or until a diagnosis can be made. Influenza, pneumonia of short duration, severe bronchitis, mild cases of diphtheria, severe acute gastro-intestinal disturbances, acute alcoholism, acute laryngitis, pharyngitis or tonsillitis, appendicitis, gall-stones, sore breasts accompanied by fever not resulting in an abscess, or any operative condition where a rapid recovery may be expected after the operation, are among the acute diseases calling for a temporary discontinuation of the breast.

If the breast is to be discontinued for only a period of from twelve to twenty-four hours, unsweetened water only may be used in the bottle for new-born infants. Older infants, those over four or five months of age, who have formerly done well on the breast and are in good general condition, may have barley gruel during this short period. If it is necessary to discontinue the breast for more than twenty-four hours, weak dilutions of cow's milk without sugar are advisable, one-third milk and two-thirds water to begin with, gradually increasing this to half milk and half water, if the infant seems hungry and has stood the weaker food well.

Case LXII

(Illustrating temporary discontinuation of the breast milk on account of operation upon mother)

November 29: Age, 6 months. Birth weight, 7 lb.
Present weight, 17 lb.
Gain since birth, 10 lb.

General Condition.—Fat; normal in every way.
Stools.—One or two normal.
Vomiting.—None.
Appetite.—Good.
Sleep.—Good.
Temperature, 98.6° F.
Chief Complaint.—Mother has gall-stones. Operation was advised by the surgeon, since she was suffering incessantly.
Previous Food.—Breast-fed exclusively once in three hours, six feedings in twenty-four hours.
Treatment.—(For mother) Operation for gall-stones. (For infant) Stop breast feedings for three days, giving

Milk	20 oz.	boiled	Divide into six feedings. Feed 7 ounces every three hours, at 6, 9, 12 A.M., and 3, 6, 10 P.M.
Water	28 oz.	boiled	
Sugar	0		

December 2 (3 days later): Weight, 17 lb.
No loss, no gain.

General Condition.—Unchanged.
Stools.—One or two constipated.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.

Treatment.—The mother now having recovered from her anæsthetic and the immediate effects of the operation, the infant was returned to the breast and nursed every four hours.

Menstruation.—Menstruation is not ordinarily a contra-indication for breast feeding. Many nursing infants are not affected in any way during the menstrual period. Others have colic, indigestion, vomiting, diarrhœa, or may stop gaining in weight during the week the mother is flowing, but progress normally between the periods. In some cases the breast milk deteriorates and it becomes evident that the infant cannot be kept upon the breast any longer. This is indicated by a permanent cessation of gain in weight or a loss in weight, and also by digestive disturbances.

CHAPTER XIX

BREAST WEANING (8 TO 12 MONTHS OF AGE)

It is never advisable to rely upon breast milk after the twelfth month, and it is usually necessary to stop the breast altogether at that age. One hears of mothers who have nursed their infants successfully for eighteen months, but the author has never seen such a case himself. On the other hand, he has seen many instances of bad malnutrition, anæmia, and rickets caused by the giving of the breast during the whole or a part of the second year.

An infant should never be weaned entirely from the breast before the end of the first year except for the failure of the milk supply or illness of the mother. Breast milk is the best food for any infant throughout the first year, provided the quality and quantity of the milk remains good for that length of time. A large majority of women, particularly in the larger cities, do not have enough milk for their infants after the seventh or eighth month. Everything should be done to keep up the milk supply until at least the eighth month, because at that time the infant may be weaned without the aid of the bottle. On the other hand, we should not persist in exclusive breast feeding if the infant does not gain at least three or four ounces a week during the second half-year. If the infant is able to get the breast milk for the first two or three months only, it is a great advantage over bottle feeding during this period, and bottle feedings are much more easily and successfully instituted after a good start upon the breast.

The weaning process should always be gradual, with the exception of instances where breast feeding is definitely contra-indicated, as discussed in the chapter on that sub-

ject. At first only one artificial feeding a day should be given unless the breast milk is extremely deficient in quality or quantity. After a week or so a second feeding may be given, and each week another artificial feeding added until the infant is weaned.

At seven months of age, and occasionally, with large, healthy infants, at six months, feedings should be given from a cup and spoon even though the breast milk is plentiful. At nine months of age, even in cases where the infant is doing extremely well upon the breast and gaining progressively in weight, it is well to begin the weaning with one artificial feeding a day. In this way an infant will learn to eat from the cup and spoon and become accustomed to foods other than breast milk, so that it can be easily and quickly weaned at a year of age without the aid of the bottle.

There are several reasons for weaning a baby without the aid of the bottle. The first and most important one perhaps is that bottles are difficult to keep clean and to handle, and there is always a certain amount of danger from infectious diarrhœas where bottle feedings are given. Another reason is that later the infant will have to be again weaned from the bottle, and it is much easier to do this weaning at eight or nine months than it is at fifteen or eighteen months. The food from the cup and spoon may be varied and the infant early made to like new articles of diet and acquire a taste for food in general. It is occasionally most difficult to teach infants to eat if they have been bottle fed up to sixteen or eighteen months of age.

Case LXIII

(Showing an infant of fifteen months who refused solid food because it was weaned from the breast to the bottle at ten months of age)

August 18: Age, 15 months. Birth weight, 6 lb. 8 oz.
Present weight, 20 lb. 14 oz.
Gain since birth, 14 lb. 6 oz.

General Condition.—Fat, somewhat anæmic, rhachitic.
Stools.—One normal per day.

Vomiting.—None.

Appetite.—*Will feed only from bottle, refusing all food from the cup and spoon.*

Sleep.—Good.

Temperature, 98.6° F.

Chief Complaint.—Refusal to take solid food.

Previous Food.—Had been breast-fed for the first ten months, when an unfortunate change to bottle feedings had been made. Two weeks ago was ordered to take potatoes, spinach, carrots, cereals, and bread besides milk. As the infant refused to take food from the cup and spoon, the mother had given this mixture of vegetables and milk from the bottle, adding milk enough to make it run through the nipple. Given in this extraordinary mixture, the object of the diet was thwarted.

Treatment.—Stop all bottle feedings at once and give solid food as directed, allowing milk in the cup only.

It was about four days before any appreciable amount of food was taken, but at the end of this period of starvation the infant was hungry enough to take any food offered. The unfortunate element of the case was that the infant had been weaned from the breast to the bottle at ten months instead of continuing the breast (partially) until a more gradual change to solid foods might be accomplished.

The Food to Give When Weaning.—When weaning an infant it is not necessary at nine months of age or with a large infant of seven or eight months to modify the milk in any way or to give complicated feedings of any sort, provided a month or so is taken in the weaning. If the infant is being nursed regularly once in four hours from 6 A.M. to 10 P.M., with no night feeding, one breast feeding may be omitted and a well-cooked cereal with milk and a cup of undiluted, unsweetened milk may be substituted for the 10 A.M. nursing. The cereal should be cooked as thick as for an adult, the finer cereals being cooked at least one hour and the coarser ones at least three hours. These cereals should be varied from day to day with cream of wheat, farina, wheatina, oatmeal, hominy, rice, Ralston's food, and cornmeal mush. The variety teaches the child to like different kinds of food, and the infant does not become accustomed to one food and refuse to take any other. The coarser cereals should be used where there is any tendency to constipation. After the infant has become accustomed to this meal another meal

of the same food may be given at 2 P.M. in place of the nursing. Later on the third meal may be substituted for the 6 P.M. breast feeding. At this time the infant is getting two feedings from the breast and three feedings from the cup and spoon. Finally, the breast may be omitted altogether and the infant put upon a four-hour schedule as follows:

6 A.M.—Cereal, milk, toast, or zwieback.

10 A.M.—Eight ounces of undiluted milk from the cup, crackers, toast, zwieback, stale bread.

2 P.M.—Milk from the cup and a cereal with milk. If the baby is one year old, a baked potato with butter may be given at this meal in place of the cereal, and a little later a purée of spinach, carrots, or green peas. After fourteen months of age an egg may be given.

6 P.M.—Eight ounces of undiluted milk from the cup, crackers, stale bread, zwieback, toast.

10 P.M.—Eight ounces of undiluted milk from the cup. The intervals at which these changes are made depend upon the quality and quantity of the breast milk, and the general condition and age of the child.

Under a year of age the weaning should be done more slowly, provided the breast milk is of good quality and there is no urgent reason for stopping its use. An infant of eight months, for instance, might have the artificial feedings substituted for the breast feedings one at a time at intervals of two or three weeks, not attempting to discontinue the breast feedings entirely until one year of age.

Case LXIV

(Illustrating the correct method of weaning an infant of eight months of age or older)

February 28: Age, 8 months. Birth weight, 7 lb. 12 oz.
Present weight, 17 lb. 3 oz.
Gain since birth, 9 lb. 7 oz.

General Condition.—Somewhat small, but exceedingly well nourished; color excellent.

Stools.—One normal each day.

Vomiting.—None.
Appetite.—Takes breast well.
Temperature, 98.6° F.
Chief Complaint.—Inability of wet nurse to supply sufficient breast milk.
Previous Food.—Breast-fed exclusively by wet nurse once in three hours, six feedings in twenty-four hours. Nurse's milk seems to have been failing lately.
Treatment.—Breast at 6 A.M., 2, 6, 10 P.M.; the 10 A.M. feeding to consist of barley gruel, 3 ounces, and milk, 3 ounces; fed with a spoon.

March 6 (6 days later): Weight, the same.

General Condition.—As above.
Stools.—Normal.
Vomiting.—None.
Appetite.—Takes feeding well from cup and spoon.
Sleep.—Good.
Treatment.—Breast at 6 A.M. and 6 and 10 P.M. At 10 A.M. and 2 P.M. give a feeding of cereal with milk upon it and a drink of undiluted milk from the cup, using at least six ounces of milk at each feeding.

March 13 (7 days later): Weight, 17 lb. 6 oz.
Gain, 3 oz.

General Condition.—As above.
Stools.—Normal.
Vomiting.—None.
Appetite.—Continues to take food well.
Sleep.—Good.
Treatment.—Give breast feedings at 6 A.M. and 10 P.M. At 10 A.M. and 2 and 6 P.M. give cereal with milk and a drink of milk as above, adding a piece of zwieback in the hand.

March 23 (10 days later): Weight, 18 lb. 2 oz.
Gain, 12 oz.

General Condition.—Excellent.
Stools.—Normal.
Vomiting.—None.
Appetite.—Good.
Sleep.—Good.
Treatment.—Breast at 6 A.M. Cereal and milk at 10 A.M. and 2, 6 and 10 P.M.

March 30 (7 days later): Weight, 18 lb. 11 oz.
Gain, 9 oz.

General Condition.—As above.
Stools.—Slightly constipated.
Vomiting.—None.
Appetite.—Excellent.
Sleep.—Good.

Treatment.—Food prescribed:

6 A.M.—Eight ounces milk with graham or oatmeal crackers.
10 A.M.—Six ounces milk, four ounces cereal.
2 P.M.—Six ounces milk, four ounces cereal, zwieback.
6 P.M.—Six ounces milk, four ounces cereal.
10 P.M.—Eight ounces milk.

Urgent Need of Breast During an Acute Illness of the Infant.—It is a great mistake to wean an infant because it is suffering from some acute intercurrent affection. There is no time when an infant needs breast milk more than during an acute illness (other than gastro-intestinal) or after any operative procedure, and many disastrous results in the treatment of these cases may be directly traced to the fact that the infant was taken away from the breast at this time. The feedings should be shortened and given not oftener than once in three hours, with plenty of water between feedings to quench the thirst.

The Treatment of the Breasts in Weaning.—Usually when an infant has been weaned from the breast gradually the breast milk has gradually disappeared, so that by the time the infant is wholly weaned there is no milk left. Where the breasts are uncomfortable, a mother should be instructed to take a sufficient quantity of Epsom salts to give her six or eight loose, watery movements a day, to restrict her liquid food to the extent of not entirely quenching her thirst. She should also be advised against the frequent use of a breast-pump, for the more frequently the breasts are pumped out the longer it will take to dry them up.

CHAPTER XX

DIARRHŒA, VOMITING, AND CONSTIPATION IN BREAST-FED INFANTS

DIARRHŒA IN BREAST-FED INFANTS

DIARRHŒA in breast-fed infants is not usually as serious nor as hard to control as that found among bottle-fed infants. Even the normal stools of a breast-fed infant are usually more watery than those of a bottle-fed infant, and are also apt to be more numerous. A breast-fed baby will usually have from three to four stools a day. The stools are brighter in color, being of an intense yellow, shading almost to orange. Minute flakes resembling small curds may be present throughout the stools of an infant that is being overfed, and are seen also in the stools of an infant that is progressing normally. Diarrhœa is not always a contra-indication for breast feeding, even as a temporary measure.

Diarrhœa in breast-fed infants is usually due to one of the following conditions:

1. Overfeeding.
2. Changes in the breast milk through a temporary illness of the mother, or other causes.
3. Acute intestinal indigestion arising from supplementing the breast with other foods.
4. Infectious diarrhœas.

Overfeeding.—Overfeeding may occur in the form of too frequent feeding (that is, feedings coming too close together), too many feedings in twenty-four hours making the quantity too great, frequent night feedings, too long a feeding, or milk that is too rich, due to overfeeding the mother. The infant that is being overfed may gain in weight progressively and still have frequent loose stools, green in color and perhaps sour-smelling and containing mucus. Many infants are fed whenever they cry, and the more they

are fed the more intestinal indigestion they have and the more they cry. The fretful, teething infant or one having a little indigestion is fed three or four times during the night, or even taken into bed with the mother and allowed to suckle the greater part of the night. The result is overfeeding and consequent numerous loose stools, instances of which, with treatment, are given in detail in Case L. Over-fed infants who are gaining rapidly in weight and who have frequent loose stools should be fed once in four hours at 6, 10 A.M., 2, 6, 10 P.M.

Allow an infant to nurse until it goes to sleep, or stops voluntarily, with the maximum time limit of 20 minutes.

If, as is occasionally the case, the bowels persist in being somewhat loose, even to the extent of six or seven loose stools a day, after everything has been carefully regulated, the breast should still be continued provided the infant is gaining well in weight and is in good general condition.

CASE LXV

(Illustrating persistent diarrhœa in an infant progressing normally otherwise)

December 20: Age, 3 weeks. Birth weight, 7 lb. 8 oz.
Present weight, 8 lb. 6 oz.
Gain since birth, 14 oz.

General Condition.—Fat, normal infant.

Stools.—Since the first week of life, *seven to nine green, watery, sour-smelling stools* a day, with mucus and fine, flocculent curds.

Appetite.—Good; nurses fifteen to twenty minutes.

Vomiting.—None.

Sleep.—Good.

Temperature, 98.6° F.

Chief Complaint.—Diarrhœa.

Previous Food.—Exclusively breast-fed once in three hours, seven feedings in twenty-four hours. Nurses until satisfied, only fifteen or twenty minutes, never more. Mother's diet excellent, her appetite good, her bowels normal.

Treatment.—(For the mother) Stop eating the coarser vegetables and some of the fruits and omit milk between meals. (For the infant) Nurse every four hours, at 6, 10 A.M., 2, 6, 10 P.M. and 2 A.M.

The infant was under observation throughout the first year. The *stools did not improve* in spite of any changes in the mother's diet, nursing times or intervals, *although there was a normal gain in weight* and the infant seemed well in every way except for the numerous loose stools.

On April 9, when it was five months old, it weighed 14 pounds 4 ounces. Its bony development was perfect, showing no rickets; its musculature was good, and it was a normal infant in every way. After this date the bowels began to improve gradually, and finally became normal, the infant still being exclusively breast-fed.

Changes in the Breast Milk from Temporary Illness of the Mother or Other Causes.—Elaborate treatment for acute diarrhœas of breast-fed infants when due to temporary changes in the breast milk is uncalled for and is apt to work harm. The author has found that if an infant is nursed regularly upon the breast the diarrhœa will quickly right itself without further treatment, undoubtedly because the changes in the milk are temporary. Such a diarrhœa may be caused by almost any acute illness of the mother, and, on the other hand, may also occur without the mother's apparently being sick. There is always the possibility that some food the mother has eaten has affected the infant, though seemingly having had very little effect upon herself. What the changes are that take place in the breast milk it is not often possible to tell, for we know very little about breast milk except its actual content of fat, sugar, protein, salts, and water. It has been asserted that the percentage of protein increases and that the fats diminish temporarily during such a disturbance, but it is doubtful if this explains entirely the cause of diarrhœa. It is advisable to give the infant plain, unsweetened water, discontinuing the breast milk for twelve hours after the onset of any form of diarrhœa.

It is a well-known fact that any nervous strain, such as a fright, a quarrel, a misfortune, a sorrow, or worry about the infant, will cause changes in the breast milk which will bring about digestive disturbances in the infant. These disturbances usually disappear so soon as the source of the trouble is removed.

CASE LXVI

(Illustrating acute diarrhœa in the breast-fed infant and its treatment)

October 28: Age, 4 months 3 weeks. Birth weight, 8 lb. 8 oz.
Present weight, 15 lb.
Gain since birth, 6 lb. 8 oz.

General Condition.—Large, fat, normal infant.

Stools.—For *two days eight to ten green, watery stools* with normal fecal odor, much mucus and fine curds, no blood. Had formerly had one or two normal movements a day.

Vomiting.—Some at the onset of the diarrhœa; none now.

Appetite.—Seems hungry.

Temperature, 98.6° F.

Sleep.—Poor.

Chief Complaint.—Diarrhœa.

Previous Food.—Breast-fed exclusively every three hours, six feedings in twenty-four hours.

At the onset of the diarrhœa there was vomiting, and for twelve hours nothing but water was given until the vomiting stopped. The mother declared that no food other than breast milk had been given to cause diarrhœa.

Treatment.—The breast to be continued at the same intervals, nursing only for ten minutes.

November 2 (5 days later): Weight, 15 lb. 2 oz.
Gain, 2 oz.

General Condition.—Unchanged.

Stools.—One or two normal.

Vomiting.—None.

Appetite.—Hungry.

Sleep.—Good.

Acute Intestinal Indigestion from Other Food Than the Breast Milk.—Without appearing to be suspicious of his directions not having been faithfully carried out, the physician should take every means to ascertain if the infant has had other food than the breast which might account for its diarrhœa. This will happen frequently without the mother's knowledge when the infant is in the care of a nursemaid or other person. An acute onset with diarrhœa, fever, and vomiting in a breast-fed infant is usually an indication that some food other than the breast milk has been given to cause it. Where such a condition prevails, the infant should be given a dose of castor oil and the breast stopped for from

twelve to twenty-four hours, substituting unsweetened, boiled water exclusively until the fever and the acute symptoms have subsided. Where a mother objects to this plan of "starvation," the white of an egg may be given raw in eight ounces of water to pacify her. The breasts may be emptied with the breast-pump if they become uncomfortably full.

Case LXVII

(Illustrating diarrhœa in breast-fed infant from irrational food)

November 1: Age, 8 months. Birth weight, unknown.
Present weight, 19 lb.

General Condition.—Fat, normal infant, except for present febrile disturbance.

Stools.—One per day until the present; *since morning there have been four green, watery, foul-smelling stools, with mucus and some curds,* but no blood.

Vomiting.—Once or twice at the onset.

Appetite.—Refuses breast.

Sleep.—Fretful all day.

Temperature, 102° F.

Chief Complaint.—Diarrhœa with sudden onset.

Previous Food.—Breast-fed exclusively once in three hours, six feedings in twenty-four hours. The nurse was suspected of giving food to baby without mother's knowledge.

Treatment.—Give two teaspoonfuls of castor oil. Stop breast feeding and give nothing but water until next visit.

November 2 (next day):

General Condition.—Appears perfectly well.

Stools.—Three large, loose, foul-smelling stools following the castor oil. Since then the bowels have not moved.

Appetite.—Hungry this morning.

Vomiting.—None.

Sleep.—Sound all night.

Temperature, 98.6° F.

Treatment.—Return to breast feedings as before.

Infectious Diarrhœas.—Infectious diarrhœas are seldom seen in infants who are exclusively breast-fed, but are not uncommon in infants who are partially breast-fed. The treatment of infectious diarrhœa in breast-fed infants does not differ greatly from that of the bottle-fed. If there is a

plentiful supply of breast milk and the baby has been breast-fed exclusively, there is no reason why the breast milk should be permanently discontinued, although a temporary discontinuation for two or even three days may become necessary. However, when there is only a small amount of breast milk or it is of doubtful quality it is generally advisable to discontinue it altogether.

Vomiting in Breast-fed Infants

Vomiting in breast-fed infants, as in bottle-fed, is of two varieties, acute and habitual.

Acute Vomiting.—Acute vomiting is the result of an acute indigestion. Its treatment does not differ in any way from that of bottle-fed infants. All food and water should be temporarily stopped, the bowels emptied, and measures recommended in the section on "Vomiting in Bottle-fed Infants" should be instituted. The breast may be discontinued until the acute symptoms have subsided and the vomiting controlled.

Habitual Vomiting.—By habitual vomiting is meant vomiting occurring after most or all of the feedings and which has persisted for a number of days or weeks. Its causes may usually be traced to one of the following conditions:

1. Errors in the details of breast feeding, mother's diet, etc.
2. Too rich milk.
3. Organic causes.

For errors in the management of breast feeding, mother's diet, etc., see Chapter XVI.

While the baby is vomiting excessively the four-hour feedings should be tried or the nursings may be shortened to three or four minutes for a day or two, being gradually lengthened to five minutes at each nursing. The foremilk being less rich in fat than the milk which comes at the end of the nursing, the shortening of the nursing period is doubly beneficial, for not only is less food taken at each

feeding, but the richer portion of the milk is left in the breasts. These short nursings, however, are never indicated until every effort has been made to regulate the mother's diet.

Some infants vomit a great deal and at the same time gain progressively in weight, the vomiting apparently doing them no harm. On the other hand, there are infants who are vomiting comparatively small amounts of food, but who are not gaining in weight nor progressing normally in other ways. Infants of this class need more food, and, where the breast milk cannot be improved by the usual methods, bottle feedings must be instituted. Mothers are apt to exaggerate the amount of the vomiting, and the physician must take this into consideration and ascertain for himself the actual amount of vomiting before advising treatment.

Milk flows much more rapidly from some breasts than it does from others. If there is a liberal supply of breast milk the milk may flow so rapidly that considerable air is swallowed and vomiting may occur as a consequence. When it has been decided that vomiting is due to this cause the condition may usually be controlled by instructing the mother upon the proper position in which to nurse her infant. (For organic causes, see page 252.)

Constipation in Breast-fed Infants

Constipation in breast-fed infants is generally due to one or more of the following causes:

1. Irregularity in nursing and too frequent nursings.
2. Constipation of the mother.
3. Insufficiency of breast milk.
4. Excessive vomiting.
5. The abuse of cathartics.

Irregular and Too Frequent Feedings.—So much has been said upon the subject of irregularity in feeding that it is only necessary to say here that it is a frequent cause of con-

stipation. Frequent and irregular feeding sets up gastric indigestion, which may be the cause of either diarrhœa or constipation. The condition is usually controlled when the mother has been directed to feed her infant at stated times (using the three-hour interval) and to stop all night feedings after three or four months of age.

Case LXVIII

(Illustrating a case of constipation from too frequent and irregular feedings)

September 14: Age, 1 month. Birth weight, 6 lb.
Present weight, 8 lb.
Gain since birth, 2 lb.

General Condition.—Well nourished.

Stools.—One yellow or green, occasionally with some mucus, but *bowels never move without a glycerine suppository or an enema each day.*

Vomiting.—A great deal immediately after each feeding.

Appetite.—Good; takes breast twenty minutes.

Sleep.—Poor and at intervals only; occasional crying.

Previous Food.—*Breast-fed exclusively* once in two or two and a half hours and two or three times in the night and *without any regularity.* Mother's diet correct, her appetite good, and her bowels move once a day with the occasional help of milk of magnesia.

Treatment.—Infant to be nursed with great regularity once in three hours, at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M., beginning with five-minute feedings, and, as soon as the colic has stopped and the bowels have become normal increasing the time of feeding to ten minutes.

September 21 (7 days later):

When the above schedule had been carried out, the constipation and colic were controlled.

Constipation of the Mother.—In a large percentage of breast-fed infants that are constipated but otherwise doing well upon the breast it will be found that the mother herself is constipated. It is impossible to overcome this condition in the infant unless the mother's condition is first corrected. The coarser articles of diet, particularly the coarser cereals, breads, and vegetables and the use of a large amount of fruit should be advised. (See "Mother's Diet," page 252.) Salad made with a simple olive-oil dressing may be eaten daily and will often act as a laxative. Any vegetable causing indiges-

tion in the mother or colic in the infant should be prohibited. It is usually better to give minute instructions about the fruit, directing that four or five apples, oranges, pears, plums, or peaches shall be eaten during the day. These may be taken between meals, as well as with the meals, and eaten either raw or cooked. Even where the mother's bowels move normally every day, the infant's constipation may be improved by instituting this change in the mother's diet.

When these dietetic measures fail it becomes necessary to give the mother a mild cathartic, and fluidextract of cascara, administered in doses of fifteen to thirty drops three times a day before eating, has been found to act best upon the infant's bowels.

Case LXIX

(Illustrating the control of constipation in a breast-fed infant by treating the constipation of the mother)

July 9: Age, 1 month. Birth weight, 8 lb.
Present weight, 9 lb.
Gain since birth, 1 lb.

General Condition.—Well nourished, normal infant.

Stools.—One a day with suppository or cathartic.

Vomiting.—None.

Appetite.—Hungry; nurses fifteen to twenty minutes.

Sleep.—Good.

Temperature, 98.6° F.

Chief Complaint.—Constipation.

Previous Food.—Breast-fed exclusively once in three hours, seven feedings in twenty-four hours. Mother's diet is correct and includes plenty of fruit and vegetables; she was taking no milk, but her bowels were stubbornly constipated.

Treatment.—(For mother) Fifteen drops of fluidextract of cascara three times a day before eating, increasing to thirty drops if necessary.

The infant's constipation disappeared under this treatment, and its bowels moved of their own accord once or twice a day thereafter.

Insufficient Food.—As one might expect, an infant who is not getting enough nourishment to gain properly in weight is very often constipated. There is not enough food to leave

a sufficient residue in the bowels to cause an evacuation of them each day. An inspection of the infant for malnutrition and a history of its gain or loss in weight will determine whether insufficient breast milk is causing the constipation. If the mother has not kept a record of the infant's weight with accurate scales, the physician should follow the weight himself for at least a week before making his diagnosis. When it has been decided that the constipation is due to insufficient nourishment, every effort should be made to improve the breast milk, and, if this is not possible, artificial feedings should be added to the breast supply. The constipation will usually disappear at once under this treatment.

Case LXX

(Illustrating constipation due to insufficient breast milk and underfeeding of infant)

May 14: Age, 5 weeks. Birth weight, 5 lb. 14 oz.
Present weight, 5 lb. 8 oz.
Loss since birth, 6 oz.

General Condition.—Poorly nourished; fontanel depressed.

Stools.—Constipated; *one small, yellow stool each day with enema,* watery in consistency and containing some mucus.

Vomiting.—None.

Appetite.—Seems hungry; nurses thirty to forty minutes.

Sleep.—Cries a great deal, night and day.

Temperature, 97° F.

Chief Complaint.—Constipation.

Previous Food.—Breast-fed exclusively every three hours in the daytime, with two or three feedings at night, eight or nine feedings in twenty-four hours. Mother's diet a very generous one, her appetite good, her bowels constipated, for which she takes fluidextract of cascara.

Treatment.—One breast for ten minutes every three hours, at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M., completing each nursing with from two and a half to three and a half ounces of the following formula:

$$\left.\begin{array}{ll}\text{Milk} \ldots\ldots\ldots\ldots & 6 \text{ oz.}\\ \text{Water} \ldots\ldots\ldots\ldots & 12 \text{ oz.}\end{array}\right\}\text{boiled and divided into seven bottles.}$$

Sugar.... 0

Each day increase the milk and allow the quantity of water to remain constant until the formula contains:

Milk........................	12 oz.	boiled and divided as before.
Water	12 oz.	
Sugar.......................	0	

May 22 (8 days later): Weight, 6 lb. 2 oz.
Gain, 10 oz.

General Condition.—Somewhat improved.
Stools.—One normal each day.
Vomiting.—None.
Sleep.—Good.
Appetite.—Satisfied.

As the food was gradually increased in strength and sugar added, the bowels remained normal and a progressive gain in weight was made.

Excessive Vomiting.—Excessive vomiting acts in the same way as underfeeding in causing constipation. The infant vomits so much that there is not enough food left in the bowel to cause a daily evacuation. Excessive vomiting is necessarily accompanied by malnutrition. Extreme instances of constipation caused by vomiting are seen in infants suffering with pylorospasm or pyloric stenosis, not enough food going through the pylorus to give a normal stool each day. To overcome this form of constipation the vomiting itself must be controlled.

The Abuse of Cathartics.—There is no more difficult form of constipation to overcome than that due to the habitual administration of cathartics. Mothers frequently give their infants castor oil or castoria because of a slight tendency to constipation. This only serves eventually to increase the constipation, and the cathartic has to be repeated. This state of affairs goes on for a time, and then the dose, to have an effect, must be increased. The treatment indicated in this case is the same as that recommended in the section on "Constipation in Bottle-fed Infants," page 194.

CHAPTER XXI

RICKETS AND SCURVY

RICKETS is a chronic disease of nutrition, with a complex pathology, the result of disturbed metabolism, chiefly affecting the bones, but also the muscles, ligaments and nearly all the organs of the body. It may occur at any age from birth to three years, but is most common during the first and second year. Although most often seen among the poorer classes, few bottle babies escaped a mild degree of rickets up to the time when Cod Liver Oil and sunlight were proven to be preventive and curative agents. On account of the anti-rachitic properties of sunlight, it is seen at its worst during the winter months in our northern climate. In the tropics and temperate zones it is almost unknown, again owing to the effects of the sun's rays. The cause of rickets is the failure to utilize calcium and phosphorus even though it is supplied in abundance in the food. A deficiency of fat and an excess of carbohydrate, particularly sugar, is a contributive cause. Normal bony growth in infants and childhood is brought about by the cartilage or osteoid tissue absorbing calcium to form true bone. In rickets the cartilage is not well calcified especially at the epiphyses where bony growth should normally be greatest. The long bones, therefore, have an unnatural flexibility and the epiphyses are enlarged, not because the cartilage is formed in excess, but because it is allowed to remain unossified. The resulting deformities of the bony frame are seen in almost every part of the body. The head is large, because of the thickening of the cranial bones, and square, owing to the formation of large bosses over the parietal and frontal eminences. It is flattened in back from pressure, giving the box-shaped

head so commonly seen in rickets. CRANOTABES is commonly seen in early infancy, usually under six months, and consists of soft spots in the cranium. Pressure over the occipital regions elicits a crackling sound and a sinking-in of the skull which gives the examiner an uncanny feeling as though the skull were as thin as paper. The ribs, being flexible, bend with the various muscular pulls and postural conditions. The prominent sternum or chickenbreast, the depressed sternum, the flaring lower ribs, with a groove around the entire circumference of the chest at the insertion of the diaphram, the flat chest, are all commonly seen. In addition, the ribs, being soft, do not respond to the outward muscular pull and instead of the chest expanding during inspiration, it gives the appearance of actually sinking in. This leads to collapse of the lung often giving the physical signs of an afebrile pneumonia. The enlarged epiphyses can be seen and felt on each rib, (so-called rosary), running parallel with the stern, and at autopsy the rosary is often found to be larger within than without the chest. The spine is bent (kyphosis), or there may be a rotary curvature and even the clavicle is deformed in severe cases. The pelvis is flattened antero-posteriorly with a narrowing of the subpubic arch. The long bones of the arm are bent, and short—the wrists and even the elbows are large at the epiphyses. The legs are curved in various places and various shapes, according to the postural and other influences, resulting in knock-knees, bow-legs, flat-foot and the so-called chairseat deformity, where the legs are allowed to hang over the edge of the chair, resulting in a general forward and outward curve of the femur. Enlargements of the epiphyses of the ankles and knees are seen. Pot-belly is due to the loss of tone of the abdominal muscles, as well as the distention of the stomach and intestines, caused by the muscular weakness of their walls and the enlarged liver

and spleen which are increased in size from simple hyperplasia. This muscular weakness also causes constipation and chronic catarrh of the colon. Dentition is delayed in certain cases, but strangely enough, the character of the first teeth is usually good, while the second teeth are often lacking in enamel. Muscular weakness is demonstrated by flabby musculature throughout the body, sweating is common, and restlessness and discomfort are due to all these factors, as well as to an impoverished condition of the nerve cells. Anæmia leads to a distinctive pallor.

The long bones fracture easily, adding to the deformity throughout the body, and as many as fifty or sixty fractures are to be found in one infant, occurring chiefly in the ribs and extremities. Although the worst types of rickets may occur in young emaciated infants, fat babies are more prone to rickets than thin ones, although the rachitic deformities may not be noticed beneath the well-covered surface. Premature infants and twins are predisposed to rickets, so much that few escape, unless energetic treatment is undertaken soon after birth. Remissions are frequent, up to two and a half or three years of age, unless anti-rachitic measures are taken throughout infancy and early childhood, for after the first year, even the most ignorant are apt to receive the proper measure of direct sunlight and anti-rachitic food.

The X-ray has aided us greatly in our study of rickets, since the uncalcified cartilage or osteoid tissue does not throw a dense shadow as does the normal bone. The first changes seen are the diminished density of the bone so that the outline at the end of the shaft is indistinct, for the lower ends of the radius, ulna, tibia and fibula, are best suited for watching the progress of rickets by means of the X-ray. In the normal child the outline is sharp and definite, while in rickets the ends of the bone fade out and are

indefinite, often terminating in a fringed border, and since the end of the shaft is broadened, a cup-like depression is seen, while the centres of ossification may not be seen at all or outlined indefinitely. Fractures and calouses and the resulting bony deformity, are easily discovered. With recovery, the shadow becomes clearer, and as healing progresses the bone appears to grow in length as the distal end of the shaft appears, and the centres of ossification become distinct. With Cod Liver Oil, sunlight and other remedial agents, recovery is rapid, and can be followed definitely with the aid of the X-ray.

Treatment.—Three remedial agents bring about the cure of rickets with extreme promptness and even rapidity, and they are equally effective in its prevention. These agents are food, sunlight and Cod Liver Oil.

So far as the food is concerned, this entire book has been taken up with its discussion, for proper feeding is essential to the prevention and cure of rickets while improper feeding with its consequent indigestion, diarrhœa and other disorders, are contributary causes. Foods also contain antirachitic vitamins as has been seen in the discussion of these accessory factors.

Sunlight was formerly little understood, and its value in pediatrics little appreciated. For years we recommended fresh air night and day and allowed our patients to stay out doors all day with the hood of the carriage pulled down so that not a ray of sunlight ever fell upon the body surface. It was feared that direct sunlight upon the baby's face would hurt the eyes, and chiefly for this reason, particularly in the winter, babies never received any of the direct sun's rays throughout the first year of life. Now it has been definitely proven that the direct sunlight will both prevent and cure rickets, as can be demonstrated by the X-ray and by blood chemistry. Rachitic infants, whose bones show the most marked lesions under the

X-ray, have been exposed to the sunlight, and inside of a few weeks the density of the bone can be seen to increase and within three months a perfectly normal shadow is observed, and with this change in the X-ray findings an accompanying clinical improvement takes place. Blood chemistry has advanced to the point where it also aids us in following the course of rickets. A rachitic infant has a very much diminished quantity of calcium and phosphorus in the blood, and while the normal calcium is 10 mg. per 100 cc., a rachitic infant may have only 6 mg. per 100 cc. and the blood phosphorus which is normally 5 may sink as low as 2.5 in rickets. The sunlight treatment brings about a return to the normal quantity of these constitutents of the blood accompanied by a clinical cure. The sunlight treatment must be used with the proper judgement. In the winter-time less surface can be exposed and for shorter intervals, but even at this season of the year, if the face and hands are exposed, the eyes turned away, so that the infant will not look directly into the sun, a very distinct benefit will result. In the summer almost the entire body can become tanned by exposing one part at a time, being careful at first exposure not to give more than ten minutes lest blistering result. The ultra-violet ray is helpful, but it is much more expensive, time consuming and troublesome and certainly no more effective, if as much so, as sunlight.

Cod Liver Oil is a specific in the treatment of rickets, as has been demonstrated in the same manner as sunlight, by X-ray and blood chemistry. Pure Cod Liver Oil should be given to all infants who cannot receive the full measure of sunlight from birth throughout the first two years of life. Small doses of the pure scientifically produced oil of codfishes livers are effective. It is best to begin with five drops three times a day after eating, and gradually increase it up to the maximum dose of two or three teaspoonfuls a day. Babies under three months of age need only twenty to

thirty drops three times a day of a potent Cod Liver Oil to prevent or cure rickets. Many of the mixtures containing Cod Liver Oil are not potent. Cod Liver Oil oxidizes easily, and during oxidization loses its potency, so that the cod's livers should not be allowed to rot before the oil is extracted as was formerly the practise, but should be removed by the proper process immediately. Codfish that are in good physical condition, having had the proper food and not spawning, give forth a more potent Cod Liver Oil.

Mothers are occasionally seen, whose infants are born rachitic or develop rickets early, when fed upon their own breast milk. Such a condition calls for the prevention of rickets pre-natally, the mother herself, partaking of anti-rachitic food and Cod Liver Oil and receiving the benefit of sunlight.

Scurvy.—Scurvy is a nutritional disorder, at present rarely seen in adults but not uncommonly found in infants, and characterized by pallor, anæmia, extreme hypersthesia, swollen spongy gums, and a hemorrhagic tendency.

The essential etiologic factor is found in a defective diet, one lacking in some accessory food which experimentation has proven to be water soluble vitamin C. Its occurrence is most frequent between the sixth and fourteenth month of life when certain artificial foods have been used exclusively. Not rarely is it produced in infants who have had long continued feedings of condensed milk, pasteurized milk, sterilized milk, or one of the proprietary foods. It is evident then that vitamin C is entirely destroyed or its action greatly diminished during the preparation of these foods.

This vitamin is present in large amounts in the juice of oranges and tomatoes. It is present also in adequate amounts in nearly all vegetables particularly yellow turnip and cabbage, but it is not found in cereals or flour. In fresh

cow's milk it is seen to have seasonal variations and the amount of destruction depends largely upon the height of the temperature and the duration of the heating. Boiling the milk for three minutes probably does not entirely destroy the anti-scorbutic properties and for this reason is considered to be the safest method of preparation for general use. From the foregoing it is not to be inferred that pasteurization or sterilization of milk should not be employed but that when milk so treated is used, the diet should be supplemented with some food containing the anti-scorbutic vitamin.

Unhygienic surroundings and neglect undoubtedly play an important role as predisposing factors.

The most constant and characteristic lesions of scurvy are found in and about the bones, particularly the long bones of the lower extremities. Of these, subperiosteal hemorrhages are perhaps the most characteristic, varying a great deal in degree but often becoming very extensive. Separation of the epiphyses is another fairly constant finding and when present is probably due to some slight trauma. There is a diminution or lack of bone formation at this point which predisposes to a certain extent to this condition. The remainder of the bone however is apparently well calcified. Hemorrhages frequently occur along the muscle planes and in the region of the joints. Microscopically aside from the subperiosteal hemorrhages there is capillary bleeding within the bone marrow. Small hemorrhages occurring on the surface of mucus and serous membranes or beneath the skin seem to be caused by changes in the blood vessel wall as the coagulability remains about in its normal state. I have seen these petechial spots appear in large numbers on the forearm of an infant following the short application of a tourniquet.

The early manifestations of scurvy are usually fretful-

ness, indisposition, gradual loss of appetite, pallor, a deep purplish discoloration along the margin of the gums and pain or tenderness of the legs on movement or pressure. Hematuria of varying degrees of severity not uncommonly occur as an early feature of the disease. The disease is so insidious in its onset that it is often not recognized until it has become well established. Later petechial hemorrhages are occasionally observed in the mucus membrane of the mouth or on the surface of the body, due to the extreme fragility of the blood vessels. Eventually the child, from the loss of appetite, disturbed sleep and gradually diminishing weight, shows all the signs characteristic of advanced scurvy, the gums becoming deeper purple in color especially at the margin of the upper and lower central incisors and demonstrating a tendency to bleed easily on the slightest irritation. They are swollen and very tender at this stage. There is also well marked swelling along the diaphyses of the bones accompanied by extreme tenderness most often involving the lower portion of the femur and tibia and the result of a subperiosteal hemorrhage or periostitis. Not infrequently there is considerable edema of the lower extremities adding, to a greater or less extent, to the swelling already present. The position the child assumes at this time makes the clinical picture a typical one. The infant lies on its back almost motionless with the thighs and legs partially flexed and outwardly rotated and any motion either voluntary or involuntary is attended with severe pain. This voluntary immobility even with mild stimulation of the soles of the feet is so marked in severe cases as to have been termed a pseudoparalysis. The temperature is usually normal except in acute cases when it may be slightly elevated.

X-ray may be of little help at first but after the disease

has progressed plates will show the characteristic subperiosteal hemorrhages, irregularities of the epiphyseal line and occasionally separation at that point.

The anæmia may be slight at first but becomes progressively worse during the course of the disease. If left untreated death may be the eventual outcome.

Scurvy and rickets are associated in a large number of cases, and in the consideration of the diagnosis the following must be kept in mind; rickets, rheumatism, osteomylitis, acute poliomyelitis, syphilitic epiphysitis, osteitis and bone sarcoma. The extreme rarity of rheumatism under one year should make one suspicious at once of scurvy where there is pain and tenderness in the legs, and located along the shaft of the bone rather than in the joints. With osteomyelitis the temperature is usually higher, there is a leucocytosis and the onset is more acute. One should not be misled in believing that the voluntary immobility of the legs is a true paralysis. Further, poliomyelitis does not show the swollen spongy gums, and X-ray of the bones reveals nothing abnormal. Syphilitic epiphysitis usually shows other evidence of syphilis and as a rule appears during the first three months of life. X-ray will usually show a periostitis. Sarcoma of bone is usually unilateral and careful observation should help to rule out this condition.

The prognosis is invariably good if not too severe and without complications, providing appropriate treatment is instituted.

As a prophylactic measure all bottle-fed infants should receive some form of anti-scorbutic food beginning as early as the second month. Orange juice should be started in small doses (one teaspoonful) daily one hour before a feeding preferably the 9 A.M. feeding. This should be increased by one teaspoonful each week providing the stools stay firm, up to the juice of a whole orange each day. Canned tomato

juice may be used in place of orange juice. The treatment of scurvy once it has developed should consist first of correcting the faulty diet, second, of administering orange juice in large quantities and if improvement is not shown within a few days the quantity increased or tomato juice added. It should be given every three or four hours night and day. Splints may be applied to the extremities to assist in relieving the pain from motion or handling.

Scurvy therefore is a disease usually seen in infants, caused by a diet lacking in one of the accessory food factors and readily relieved when this factor is again added to the diet. In view of this fact it is indeed unfortunate that scurvy should develop when the disease is so easily preventable.

CHAPTER XXII

THE USE OF BOILED MILK IN INFANT FEEDING

There are two distinct and entirely different reasons for boiling cow's milk during the first year of an infant's life: First, to destroy any harmful bacteria which the milk may contain, and by so doing to prevent disease; and, second, to make the milk more digestible and to prevent or overcome any digestive disturbances, provided boiling has this effect upon the individual infant. In this country the bacteriological content of milk has attracted so much attention that we have not studied sufficiently the difference in the digestibility of boiled and unboiled milk, for we must study the problem entirely apart from the bacteriological side.

All pediatricians are agreed that milk from healthy tuberculin-tested cows, and with a low bacterial content, is advisable for infant feeding purposes. It is the general consensus of opinion in America that good milk need not be boiled, although some authorities are of the opinion that all milk fed to infants should be pasteurized. We are also agreed that when it is impossible to procure good milk sickness can be avoided by pasteurization or boiling, and that one or the other is necessary when a good milk supply is not available. The only question then, so far as the bacteriology of milk is concerned, is whether pasteurization or boiling of milk may be continued over a prolonged period without harmful results.

Perhaps an even more important phase of the question is whether the boiling of cow's milk so changes it that it is better borne by infants who have a low digestive capacity or who are suffering from actual digestive disturbances.

Our problem, then, divides itself into several subheads.

1. Does the prolonged use of boiled milk cause nutritional

disorders such as rickets, anæmia, malnutrition, poor musculature, or scurvy?

2. Does the change from unboiled to boiled milk cause digestive disturbances when fed to infants who have no difficulty in digesting unboiled milk?

3. Does the change from boiled milk to unboiled milk ever cause digestive disturbances?

4. Does boiled milk aid us in overcoming digestive disturbances such as intestinal indigestion, with or without diarrhœa, or vomiting?

5. Does boiled milk cause constipation?

6. Is boiled milk as readily assimilated as unboiled milk, or is the nutritional value of milk lessened by boiling?

There are three ways of attacking these problems: First, laboratory experiments; second, animal experiments; and, third, clinical observations upon babies. There has been a great deal of work done and there is a vast amount of literature from the first and second viewpoints, but very little has been written upon the clinical side of the question. Laboratory and animal experiments are very valuable, but the real test of any feeding problem is the actual result obtained in a series of babies who are carefully observed over a long period of time. Most of those who have written upon this subject have concluded that actual clinical observations were necessary to determine the relative value and usefulness of boiled and unboiled milk in infant feeding. Some of the animal and test-tube experiments, although interesting and instructive, do not throw any real light upon the practical problem of feeding. For instance, whether calves do as well upon boiled cow's milk as they do upon unboiled milk of their own species, and whether babies do as well upon boiled human milk as upon unboiled milk of their own species cannot help us to decide the problems which are enumerated above. At best the feeding of cow's milk to infants is an

Fig. 14.—Scurvy, with swelling over tibia and femur of both legs.

artificial procedure, and we must not allow such analogies to confuse us.

In approaching the subject from a clinical standpoint, it is necessary that the infants upon whom any feeding experiments are tried should have good care and the proper hygienic surroundings in order to be under the most favorable and natural circumstances. For this reason it would be better not to take institution infants nor those in the lower walks of life whose hygienic surroundings are poor. The following cases are selected from private patients and the better class of dispensary patients, whose intelligence can be relied upon to carry out the directions given.

Does the Prolonged Use of Boiled Milk Cause Nutritional Disorders Such as Rickets, Anæmia, Malnutrition, Poor Musculature, or Scurvy?—First, we must realize that in this question we are hampered by tradition. We have all been taught and have heard it repeated so many times that boiled milk is liable to cause nutritional disturbances that it is difficult to put one's self into an open-minded attitude toward the subject. Where this theory originated no one seems to know, but surely there is no conclusive evidence found in medical literature to prove that boiled milk does cause these nutritional disturbances.

Morse, in a very thorough review of the literature upon the subject, says that there is relatively little evidence on either side, although he quotes Finkelstein as saying that there was no evident difference in the results with raw and cooked milk in reference to sixty well and fifty-three sick babies. Leopold did not find any evidence of rickets, anæmia, or malnutrition in a number of infants fed with Schloss milk over a long period.

In a very active pediatric practice and hospital experience, the author has used boiled milk mixtures almost exclusively for the past sixteen years (at the present writing). He has fed many hundreds of infants of all ages and condi-

tions of nutrition, and has fed them boiled milk mixtures throughout the bottle period, in many of them from birth. He has had the opportunity of observing hundreds of his private cases throughout early childhood. Nutritional disturbances are rare indeed among these patients, while formerly they were far more frequently seen when raw milk mixtures were used as a routine. A more robust, rosy series of children with firmer muscles and more normal appearing bones would be hard to find. The author is therefore convinced beyond all question of doubt that boiled milk does not cause rickets, malnutrition, anæmia, or poor musculature.

The mixtures used were simple milk dilutions, usually beginning with one-third milk and gradually increasing up to one-half milk, two-thirds milk, or three-quarters milk. The carbohydrate used was either cane or malt sugar or malt soup mixtures. In boiling the milk, the milk and water were first mixed together and brought rapidly to a boil, stirring constantly so that no scum formed upon the top, and after it had come to the boiling-point it was allowed to boil actively for three minutes. It was then taken off the stove and put into the bottles for the day, and rapidly cooled.

These infants were carefully observed throughout this period, being watched especially for evidences of rickets and anæmia. Most of them had a certain degree of malnutrition when they came under observation, and a few of them had poor bony development. Many of them had marked rickets at the beginning, which improved with noticeable rapidity, so that at the end of the bottle period the fontanel was normal in size, the sutures united, and there were no remaining evidences of it.

They did not develop rickets, but as a whole showed a marked improvement in nutrition and musculature; and developed into normal, healthy infants. The condition of the skin, the hair, the color, the general alertness, and sense of

well-being were exceptionally good, all of which cannot be recorded in figures nor be graphically shown, as is so easily done with the weight chart.

Scurvy did not develop in any. In all probability this was because orange juice was given daily throughout the period of boiling the milk. If this precaution is taken when boiled milk is given over any extended period of time we might eliminate the question of scurvy. Since severe cases of scurvy can be overcome in a few days' time by administering orange juice, even though boiled milk is continued, it would be only logical to conclude that orange juice will prevent scurvy. Undoubtedly there is evidence in the literature that scurvy is produced by boiled milk feedings when orange juice is not given.

Does the Change from Unboiled to Boiled Milk Cause Digestive Disturbances When Fed to Infants Who Have No Difficulty in Digesting Unboiled Milk?—It has been the author's custom for many years to use boiled milk when starting to feed infants upon cow's milk for the first time, and, although the majority were having digestive disturbances or malnutrition, a certain number of cases were normal infants without digestive trouble. It is occasionally advisable to boil an infant's food for a journey or when out of town where the milk supply cannot be relied upon. The author has never seen a single instance where this change from unboiled milk to boiled milk caused any gastric or intestinal indigestion. On the other hand, as stated below, boiled milk has repeatedly been used in infants who have digestive disturbances, with the result that such disturbances were overcome. Whether this would be true of top milks with a high percentage of fat is not known, as the observations were entirely limited to the use of simple dilutions of full milk or occasionally skimmed milk. Formerly, in starting infants

for the first time on cow's milk, it was a frequent occurrence to see those with a normal digestion get up digestive disturbances, and upon boiling the milk to have these disturbances disappear. As an experiment, the author changed a group of infants who were doing well upon unboiled milk to boiled milk without causing digestive disturbances. This has, therefore, forced the conclusion that the change from unboiled milk to boiled milk does not cause indigestion either in the form of vomiting, diarrhœa or discomfort, though this was formerly contrary to popular opinion in this country.

Does the Change from Boiled Milk to Unboiled Milk Ever Cause Digestive Disturbances?—Further evidence that boiled milk is more digestible than unboiled milk is found in individual cases who have no digestive disturbances when given boiled milk feeding, perhaps over a prolonged period, but who get up digestive disturbances when the boiling of the milk is stopped. It was formerly the author's routine procedure to boil the milk for intestinal indigestion and to continue this diet for two to four weeks after the digestive disturbances had been overcome, then change to the unboiled food. For a few days after this change is made some infants will have stools which are normal in character except for a few large, tough, beanlike curds, which appear in almost every stool and which seem to cause no discomfort nor other adverse symptoms. Other infants will get up a rather severe intestinal indigestion and diarrhœa either immediately after the change from boiled to unboiled milk or three or four days later. The author has seen digestive disturbances and diarrhœa occur in so many cases as a result of the change from boiled to raw milk, that there is no question as to the cause, although many well infants with a normal digestive capacity stand the change very well; in fact, by far the majority of them do.

Case LXXI

(Illustrating the manner in which curds repeatedly occur in the stools when raw milk is substituted for boiled milk)

December 18: Age, one month. Birth weight, 6 lb. 2 oz.
Present weight, 8 lb. 2 oz.
Gain since birth, 2 lb.

General Condition.—Well nourished, well developed.
Stools.—Normal.
Vomiting.—None.
Appetite.—Good.
Sleep.—Good.
Temperature, normal.
Previous Food.—Since birth had been fed on boiled milk mixtures, gradually increased to

Milk	16 oz.	boiled	Fed 4 ounces every three hours, seven feedings in twenty-four hours.
Water	16 oz.		
Dextri-maltose..	1 oz.		

Treatment.—Food prescribed:

Milk	16 oz.	unboiled	Feed 4 ounces every three hours as before.
Water	16 oz.		
Dextri-maltose ..	1 oz.		

December 24 (6 days later): Weight, 8 lb. 8 oz.
Gain, 6 oz.

General Condition.—The same.
Stools.—*For five days has had two rather foul stools a day, containing tough, hard curds.*
Vomiting.—A little after each feeding.
Appetite.—Good.
Sleep.—Good; cries a little.
Temperature, normal.
Treatment.—Boil the food.

December 25 (1 day later): Weight, 8 lb. 8 oz.

General Condition.—The same.
Stools.—Two normal a day.
Vomiting.—None.
Appetite.—Good.
Sleep.—Good; does not cry very frequently.

Treatment.—Try giving milk raw again.

January 4 (10 days later): Weight, 9 lb. 8 oz.
Gain, 1 lb.

General Condition.—The same.

Stools.—Twenty-four hours after beginning to give raw milk *the curds appeared* in the stools, and continued throughout the period.

Vomiting.—Very little after each feeding.

Appetite.—Good.

Sleep.—Good; cries occasionally.

Treatment.—Temporarily boil the milk again to reduce curds. Since the infant was gaining steadily in weight and had no other symptoms of indigestion, the raw milk was resumed after twenty-four hours.

January 11 (7 days later): Weight, 9 lb. 15 oz.
Gain, 7 oz.

General Condition.—The same.

Stools.—*Curds reappeared* within twenty-four hours of giving unboiled milk, but grew gradually less during the week.

Appetite.—Good.

Sleep.—Good.

Vomiting.—None.

Treatment.—Food unchanged.

January 16 (1 month from beginning of experiment): Weight, 10 lb. 2 oz.
Gain, 2 lb.

After these repeated alternations between boiled and raw milk, the infant continued to gain in weight and thrive normally upon the unboiled milk.

From observation and repeated experiment, it is very evident that infants who have been kept on boiled milks for a very long time are more easily affected when the boiling is stopped.

Case LXXII

(In which boiled milk feedings had to be used throughout the bottle period because raw milk caused severe intestinal indigestion)

Twins. Birth weight, unknown.
April 5: Age, 6 months. A's weight, 13 lb. 14 oz.
B's weight, 14 lb. 2 oz.

General Condition.—Normal, well-nourished infants.

Stools.—Two normal a day.

Vomiting.—None.

Appetite.—Good.

Sleep.—Good.

Temperature, normal.

Previous Food.—Had been breast-fed up to six weeks of age. Were then given boiled milk mixtures, with occasional feedings of raw milk, which always caused indigestion. Were now so well and strong that it seemed unnecessary to continue boiling the milk.

Treatment.—Give raw milk.

April 8 (3 days later): A's weight, 13 lb. 15 oz.
B's weight, 14 lb. 4 oz.

General Condition.—The same.

Stools.—A had three to four loose stools a day, containing mucus and curds. B had three normal stools a day.

Vomiting.—None.

Appetite.—Good.

Sleep.—Fair; both cry more than usual.

Treatment.—Continue raw milk.

April 10 (2 days later): A's weight, 13 lb. 15 oz.
B's weight, 14 lb. 5 oz.

General Condition.—The same.

Stools.—B developed diarrhœa. A's stools remained the same.

Vomiting.—None.

Appetite.—Good.

Sleep.—Good at night; appear restless during the day, with evidences of colic.

Treatment.—Continue raw milk for twenty-four hours longer only, unless stools improve.

April 14 (4 days later): A's weight, 14 lb. 1 oz.
B's weight, 14 lb. 5 oz.

The stools gradually got worse until there were five or six mucous, curdy, watery stools a day, with a great deal of restlessness and evident colic and a cessation of gain in weight. The milk was given boiled.

April 19 (5 days later): A's weight, 14 lb. 3 oz.
B's weight, 14 lb. 8 oz.

It proved to have been a very severe intestinal indigestion, and it was five days before the bowels again became normal and the infants seemed happier.

For this reason the boiled milk was continued until the infants were eight months of age, when with difficulty they were weaned to raw milk.

In many cases, giving only two feedings of unboiled milk a day, the rest being boiled, caused a diarrhœa which stopped when the boiling of the entire feedings was resumed. After one case of the series had been fed boiled milk for one month, two feedings a day were given unboiled, as the bowels were constipated. Three or four days thereafter the stools showed a good deal of mucus and curds, and the boiling was resumed, with the usual result that the stools became normal again. A week later two feedings a day were again given unboiled, the rest being boiled, and again a diarrhœa developed. This same experience was repeated in another infant, after the boiled milk feedings had been used continuously for seven months.

It is impossible to prophesy whether the change from boiled to unboiled milk is going to cause digestive disturbances in an individual infant or not. Undoubtedly those infants who have been most difficult to feed and have had frequent attacks of intestinal indigestion are more liable to get up diarrhœa when the boiling is stopped. The criticism naturally might be made that some or all of these diarrhœas were due to an infection, but, in the first place, the course and symptomatology is never that of an infectious diarrhœa, as there is no temperature nor other evidence of toxæmia. In the second place, certified milk was used and every precaution taken in the proper icing of the milk, care of the bottles, nipples, etc., in many instances by a trained nurse who is thoroughly familiar with the dangers of milk infection.

A very interesting experiment was conducted some years ago, during the summer, in the Babies' Wards of the New York Post-Graduate Hospital. There were thirty cases of various kinds of gastro-enteritis that were being bottle-fed in the wards. Boiled milk had been given as a routine for two weeks with varying success, although not a single one of the infants had any tough, hard curds in the stools. A

sweeping order was given to stop boiling the milk, and in every instance the curds appeared. In three days another sweeping order was given to boil all the milks, and in twenty-four to thirty-six hours the stools of all the infants were free of curds. This result has been repeated so frequently in the author's experience that there can be no doubt in his mind that changing from boiled to unboiled milk is a cause of digestive disturbances.

Does Boiled Milk Aid us in Overcoming Digestive Disturbances Such as Intestinal Indigestion, with or without Diarrhœa, or Vomiting?—There are so many different factors that enter into the treatment of the various digestive disturbances that one must be careful when he attributes his success in treating a single case or a series of cases to any single one of these factors, such as the boiling of the milk. The intervals between the feedings, the quantity at a feeding, the caloric value of the food, the amount and kind of sugar used, the addition of starches or dextrinized starches, the dilution, the percentages of fat and protein, the kind of milk used, the proper preparation of the food and carrying out of the directions, all play an important part in overcoming digestive disturbances. It may be assumed that intestinal or gastric indigestion cannot be influenced by any procedure when the details are not properly carried out.

It has been my custom to begin the treatment of almost all my cases of simple intestinal indigestion (and this does not include cases of infectious gastro-enteritis) with a mixture of about one-third milk and two-thirds water, boiled as above described. No starch or sugar or alkali is added to the mixture. The simplicity of this procedure and the almost universal application of it eliminates many complicating problems, and, since it is almost always successful in overcoming the digestive disturbances in the proper class of cases, it is fairly easy to determine whether the boiling of the milk is, in part at least, responsible for the good results

obtained. It is very evident that many cases of intestinal indigestion cannot be successfully treated with this mixture unboiled.

CASE LXXIII

(In which the stools were made normal by boiling the milk without changing the food in any other way)

May 4: Age, 4 months 2 weeks. Birth weight, 9 lb. 8 oz.
Present weight, 10 lb. 8 oz.
Gain since birth, 1 lb.

General Condition.—Very poorly nourished; rough skin; malnutrition; good bony development.

Stools.—Six or seven green, watery, mucous, curdy stools in twenty-four hours.

Vomiting.—None.

Appetite.—Hungry.

Sleep.—Good.

Temperature, 98.6° F.

Chief Complaint.—Diarrhœa.

Previous Food.—

Milk ...... 18 oz. } temporarily unboiled
Water..... 18 oz. }

Fed 5– ounces every three hours, seven feedings in 24 hours.

Treatment.—Boil the food.

May 7 (3 days later): Weight, 10 lb. 9 oz.
Gain, 1 oz.

General Condition.—The same.

Stools.—Two soft, yellow, homogeneous stools.

Vomiting.—None.

Appetite.—Hungry.

Sleep.—Good.

Treatment.—Continue boiling the food.

The bowels remained normal and the infant improved as the milk was increased and sugar added.

In fifty-two cases of diarrhœa from intestinal indigestion which were treated with boiled milk mixtures the stools became normal in from two to five days. The ages varied from three weeks to one year. The stools varied from three to twenty per day, all of them showing evidences of indigestion and most of them containing mucus and curds. As many of these cases were treated in summer as in winter. The weights varied from four pounds five ounces to nineteen

pounds four ounces, the majority of them being small, emaciated, young infants. The previous feeding varied from simple barley gruel, which in some cases had been used for a prolonged period without overcoming the diarrhœa, to the more complicated top milk and whey mixtures and the various proprietary foods. There were all classes of intestinal indigestion, but no acute infectious diarrhœas included in the group, as such cases have too many complicating elements to be of any value in deciding whether boiled milk is more easily digested than unboiled milk in the average infant. However, it may be said in passing that if boiled milk is more easily digested than unboiled milk it should naturally follow that cases of acute infectious diarrhœa which require milk feeding should receive the milk boiled.

The series of cases in which the unboiled milk was used in the same dilution is small, because of the poor results obtained, as it did not seem fair to the infants to allow them to continue with the unboiled milk when the stools did not improve under this treatment. A typical case treated with unboiled milk is as follows:

Case LXXIV

(Illustrating intestinal indigestion in which the diarrhœa persisted with raw milk mixtures, but was promptly relieved upon boiling the same mixture)

August 1: Age, 4 months. Birth weight, unknown.
Present weight, 9 lb. 14 oz.

General Condition.—Poorly nourished; good bony development; smooth skin.
Stools.—Three loose, watery stools a day, with much mucus and many curds.
Vomiting.—A great deal at every feeding.
Appetite.—Ravenous.
Sleep.—Poor.
Temperature, 98.6° F.

Previous Food.—

10 per cent. top milk....	5 oz.	boiled	Fed 3+ ounces every three hours, seven feedings in 24 hours.
Water..................	20 oz.		
Lime water............	2 teaspoonfuls		
Milk sugar	4 teaspoonfuls		

Treatment.—Food prescribed:

Milk	10 oz.	unboiled	Feed 4 ounces every three hours as before.
Water.........	20 oz.		
Sugar.........	0		

August 7 (6 days later): Weight, 10 lb. 2 oz.
Gain, 4 oz.

General Condition.—The same.

Stools.—Unchanged, except that curds became hard and tough instead of soft as before.

Vomiting.—Continues.

Appetite.—Still hungry.

Sleep.—Poor.

Treatment.—Food unchanged in substance or quantity, but boiled.

In three days the stools became smooth, homogeneous, and free f om curds and mucus.

There were ten cases in this series which included the same kind of infants as in the boiled milk series. In only two did the stools clear up without resorting to the boiled milk, and those were infants who had formerly been receiving extremely bad feeding, one a very high fat and the other very high sugar. In the other eight the diarrhœa was allowed to go on for seven days in three cases, nine days in three cases, and twelve days in two cases, before the boiled milk feedings were instituted. In all of these cases the stools became normal inside of five days after beginning the boiled milk.

These boiled milk mixtures are particularly useful in the small, young, poorly-nourished infants, who do not do well on an exclusive carbohydrate diet, such as is so frequently given for a few days before starting milk feedings. It is probably the experience of all of us that the older, well-nourished infants, say above six months of age, who have intestinal indigestion, are best treated with either an entire cessation of food for twelve to twenty-four hours, or a starch diet, such as the various gruels and perhaps bread pap. But the younger, smaller infants and those with malnutrition who are suffering from the lack of food do not do well with

this treatment. It is not an uncommon experience to see infants of this class who have been fed barley gruel for a period of a week or more with no improvement in the stools and with a marked loss in weight and strength.

It is not easy to determine the effect of boiled milk on the gastric digestion. Cases of severe vomiting were stopped or the severity much diminished when boiled milk mixtures were given in simple dilutions. However, this generally occurred in infants who came under observation for the first time, and whose feeding had previously been more or less irrational. Beside that, the sugar is usually cut down in amount and many other proper changes are made.

On the other hand, there are certain infants whose vomiting *does not stop* with the boiling of the milk, but in the author's experience, at least, vomiting *has never been caused* by the change from unboiled to boiled milk, or *vice versa.* Undoubtedly the large, tough curds that are seen in the stools of some infants fed with unboiled milk are originally formed in the stomach, and unboiled milk stays in the stomach longer than boiled milk, both of which facts are shown by Brennemann.

Does Boiled Milk Cause Constipation?—Constipation in the bottle-fed has so many different causes that it is difficult to prove what part the boiling of the milk plays in its etiology. In many infants who were constipated when the boiled milks were started the constipation was overcome during the period that the boiled milk was fed. In others the constipation persisted with the boiled milk feeding, but was relieved when unboiled milk was given. Still others who were constipated on the boiled milk feeding were just as constipated after the feeding was changed to unboiled milk. None of the babies who received the malt soup extracts were constipated at any time while taking this food, which shows that, even if constipation is caused by boiled milk and water mixtures, adding certain elements to the food will overcome

the trouble in spite of the boiling. Infants who have diarrhœa for which boiled milk is instituted often acquire a much-welcomed constipation. The constipation is then usually overcome as sugar is added to the food and as the food is increased in quantity and strength.

Of the thirty-one infants who were constipated at some time while they were receiving boiled milk as a food, in nineteen the constipation was overcome before the food was changed to unboiled milk, in six the constipation was relieved by stopping the boiling, and in six others the constipation persisted in spite of the change from boiled to unboiled milk.

It would seem, then, that, although constipation more frequently occurs in infants fed upon boiled milk, in certain cases it may be overcome while the baby is fed upon boiled milk, and that stopping the boiling does not always stop the constipation.

Is Boiled Milk as Readily Assimilated as Unboiled Milk, or is the Nutritional Value of Milk Lessened by Boiling?—This is a phase of the question that cannot be decided by clinical work. There is a certain loss of fat and proteid when scum is allowed to form on the top of the milk, but if it is stirred constantly and brought rapidly to a boil this scum is not formed. Even with this detail carried out, there is probably a small loss in the nutritional value of the milk. The only evidence (which is not at all conclusive) is based upon the increase in the infant's weight on stated amounts of boiled and unboiled milk.

CHAPTER XXIII

DRY MILK

Dry milk is a powder made from fresh cow's milk by the evaporation of the water. The liquid milk is instantaneously dried as it flows over hot revolving cylinders and in its dry state contains all of the original elements except water. The powder is put up in cans and is readily prepared for feeding purposes by dissolving it in hot water.

Bonnamour fed fifty-six infants over prolonged periods on dry milk. He found that dry milk was extremely useful and especially valuable in cases of sickly infants, who, while unable to digest milk in other forms, could yet take dry milk readily and make good progress. He states that he had only met five cases of intolerance to dry milk in the course of eight years' experience and expressed himself converted from a former state of doubt as to the value of dry milk.

Naish says, "I have followed up a considerable number of infants fed on dried milk, and I am personally convinced that there is no more risk of rickets with this diet than with a good quality of raw cow's milk." He also states that it is possible to cure rickets by changing a previously given diet to a dry milk diet.

C. Killick Millard states: "It was very soon discovered, however, that dry milk had one most important advantage—greater digestibility—and that many infants would retain it and at once begin to thrive who previously had been continuously subject to vomiting after each feeding and in consequence were making little or no progress. . . . A careful watch has been kept for any bad effects, such as scurvy or rickets, but although I have had experience of some hundreds of infants fed on it for periods ranging up to ten months, or even longer, so far none have been seen.

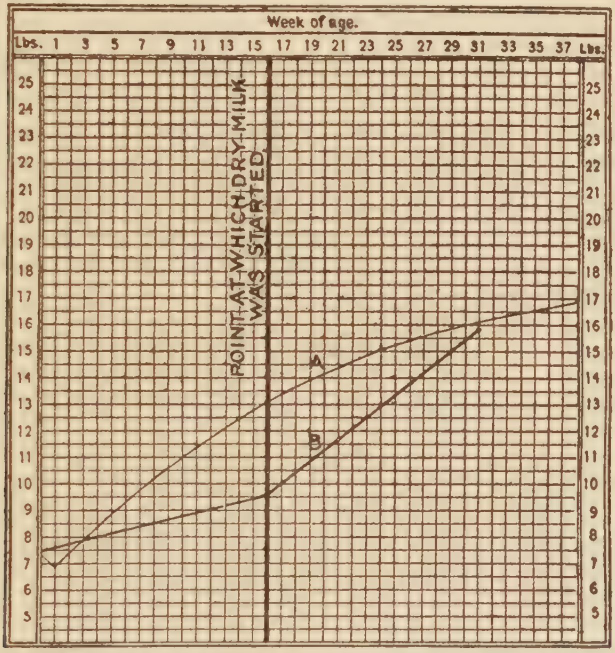
Inquiries have also been made from fifteen medical men practicing in the districts whence most of the cases have been drawn, and their replies in all cases were favorable to the use of dry milk, and support the conclusions that no bad effects have followed.''

Dry milk has long been used in the so-called proprietary foods, among them Nestlé's Food, Allenbury's Food, Mammala, Malted Milk, and so forth. The main fault that could be found with these preparations is that most of them contain other ingredients besides cow's milk. Nestlé's food, for instance, is stated on the package to be ''a compound of milk, baked wheat flour, wheat malt and sugar only.'' Allenbury's food is stated by the manufacturer to be made of milk, cream and milk sugar modified to ''imitate the percentages of breast milk,'' evaporated in vacuo and sold in powder form. Mammala is stated by the manufacturers to contain fifty-four per cent. of milk sugar, and most of the malted milks contain a large percentage of maltose and dextrine besides the dry milk.

One can readily see the advantages of a dry milk which has nothing added to it, neither sugar nor starch, for many infants, especially the difficult feeding cases, have an intolerance for the various sugars or for starch, and dry milk which has no sugar or other ingredients added to it will be more easily digested and therefore superior to any of those preparations that are sold with the sugar or starch already mixed in it. On the other hand, the addition of these ingredients may be ordered if any of them are considered necessary for the individual at hand.

It has been the author's clinical observation that dry milk is better tolerated by those infants who have already received a food injury, than raw milk or boiled milk mixtures. These observations were originally based upon a close study of over fifty cases in private practice which were followed over a prolonged period with the utmost care. Since then

the series has been much larger and the same conclusions hold true. It is usually wise to turn to the use of dry milk as soon as it is found that the individual infant does not prosper upon ordinary milk mixtures of fresh liquid milk. Often with the change to dry milk the improvement is marked, and in many instances, the relief from digestive



symptoms is immediate. Without exception, in all of the cases where there was no organic disturbance, such as pyloric stenosis, tuberculosis, syphilis, etc., the results have been surprisingly good. Vomiting is often controlled within twenty-four hours, intestinal indigestion immediately overcome and an increase in weight begun at once.

In the composite weight chart "A" represents the weight curve of a normal infant (Holt) and "B" the average weight of my fifty cases. When the dry milk was begun they aver-

aged three and one-half pounds below the normal, whereas the average weight had reached the normal point when the food was discontinued or other foods begun.

Case LXXV

(Illustrating the use of Dry Milk where the usual milk mixtures disagreed)

October 15: Age, 9 months. Birth weight, 6 lb. 3 oz.
Present weight, 9 lb. 11 oz.

General Condition.—Poorly nourished.
Stools.—Two firm normal.
Vomiting.—Good deal after almost every feeding.
Appetite.—Good.
Sleep.—Restless, fretful, slept but little in daytime.
Temperature, 98.6° F.
Chief Complaint.—Failure to gain.
Previous Food:

Breast-fed the first month, then malted milk mixtures, and for the last five months he has been very intelligently fed with fresh milk modifications with various sugars, but without great success.

Treatment.—Food prescribed:

Dry milk ..... 2 tablespoonfuls
Water .... 6 oz.

Feed 6 oz. every 3 hours, at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.

Every second day increase the dry milk one tablespoonful, up to five tablespoonfuls, in 6 oz. of water.

October 22 (7 days later): Weight, 10 lb. 8 oz.
Gain, 13 oz.

General Condition.—Improved.
Stools.—Two normal.
Vomiting.—None.
Appetite.—Good.
Sleep.—Good.
Treatment.—Food prescribed:

Food unchanged.

The vomiting was much diminished from the start and after a week it practically ceased. There was a continuous gain in weight, and on January 16th, three months later, the baby weighed eighteen pounds six ounces, a gain of over seven pounds in three months.

There are comparatively few facts to learn in using dry milk; in fact, the simplicity of the whole procedure is one of its desirable features.

The food must be made fresh at each feeding by dissolving the proper quantity of the dry milk powder in the proper

quantity of hot water. In order to furnish fifty calories per pound per day *give three tablespoonfuls, levelled with a knife, of dry milk for every pound of the body weight,* since a tablespoonful has sixteen calories. For example, a seven-pound infant needs in twenty-four hours twenty-one tablespoonfuls. If the infant is given seven feedings a day (three-hour intervals) each feeding would therefore contain three tablespoonfuls of dry milk.

As a matter of fact, only very poorly nourished infants need as many as fifty calories per pound of dry milk. Well-nourished or fat babies gain progressively on forty calories per pound per day (or even less), which can be furnished in two and a half tablespoonfuls for each pound of the body weight. The reason for this low caloric requirement is that dry milk is more easily digested and is probably more fully utilized than raw milk, and less energy is required for the digestive processes.

The maximum strength of the food is one tablespoonful to the ounce of water, weaker solutions always being used at first.

When beginning dry milk with an infant that has already had marked digestive disturbances or a food injury, it is advisable to give much less than the infant actually needs and increase the tolerance just as you would with any other food, although it is noticeable that the tolerance is much more quickly increased for dry milk than it is for fresh cow's milk or sugar. Begin with one tablespoonful (one-eighth of an ounce by weight) in two to four ounces of water, according to the age and size of the infant. In twenty-four hours two tablespoonfuls to each feeding may be used and a day or two later three tablespoonfuls, and so on until the caloric requirements are fulfilled. An infant of average size and weight may have at each feeding one or two more ounces of food than the number of months of its age with a minimum quantity of three ounces and a maximum of eight

ounces. Undersized or vomiting infants must have less. This method of increasing the tolerance is well illustrated in the following case:

Case LXXVI

(Illustrating rapid increase in tolerance when using Dry Milk)

July 2: Age, 2 months. Birth weight, 8 lb. 6 oz.
Present weight, 8 lb. 1 oz.

General Condition.—Poorly nourished.
Stools.—Five to six green, watery, with mucus.
Vomiting.—Good deal after each feeding.
Appetite.—Hungry.
Sleep.—Restless.
Temperature, 98.6° F.
Chief Complaint.—Sleepiness, vomiting, loose stools, failure to gain.

Previous Food:

He was breast-fed the first two weeks of life and since then had Imperial granum, malt soup and various other modifications of cow's milk.

Treatment.—Food prescribed:

Dry milk ...... 1 tablespoonful
Water .... 3 oz.

Feed three ounces every three hours, seven feedings in twenty-four hours, at 6, 9, 12 A.M., 3, 6, 10 P.M., 2 A.M.

July 3: Weight, 8 lb. 2 oz.

General Condition.—Same.
Stools.—Three green loose, no mucus.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Poor.

Treatment.—Food prescribed:

Dry milk ..... 2 tablespoonfuls
Water .... 3 oz.

Feed 3 oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M., 2 A.M.

July 5: Weight, 8 lb. 4 oz.
Gain, 2 oz

General Condition.—Same.
Stools.—Three firm, smooth, yellow.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Fair.

Treatment.—Food prescribed:

Dry milk ..... 3 tablespoonfuls
Water .... 4 oz.

Feed 3 oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M., 2 A.M.

July 10: Weight, 8 lb. 12 oz.
Gain, 8 oz. in 5 days.

General Condition.—Improved.
Stools.—Two firm normal.
Vomiting.—None.
Appetite.—Good.
Sleep.—Good.

Treatment.—Food prescribed:

Dry milk	4 tablespoonfuls	Feed 4 oz. every 3 hours at 6, 9,
Water	4 oz.	12 A.M., 3, 6, 10 P.M., 2 A.M.

The vomiting never recurred, nor was there any subsequent looseness of the bowels, and he continued to gain progressively in weight.

Leaving aside the question of digestiblity of dry milk, there are many distinct advantages of milk sold in this form. The lessening of the bulk by the removal of water makes it easier and cheaper for transportation. When properly prepared it is sterile and is therefore not a source of disease. It will keep without even any changes in the butter fat for a period of at least a year. After the can has once been opened it does not spoil and it is not easily contaminated, as, for instance is condensed milk.

The simplicity of its preparation for feeding purposes by simply adding the dry milk powder to hot water is a distinct advantage and therefore makes it available for the masses, and superior for the ignorant and uncleanly. And finally, where good milk is not available, as, for instance, in the smaller cities and towns where the gospel of certified milk has not penetrated, or in countries where climate or other conditions prevent proper dairying, or in times of war, it might be considered almost invaluable.

Dry milk is not a panacea, for there never will be such a thing as a panacea in infant feeding. It is only one more weapon with which to combat digestive disturbances, one more resource at hand to use with infants of feeble digestion and to tide over a critical period in selected cases.

The very worst feeding case that the author has ever treated is:

CASE LXXVII

(Illustrating the use of Dry Milk in the worst feeding case imaginable)

July 23: Age, 2 years, 1 month. Birth weight, 7 lb. 8 oz.
Present weight, 9 lb. 2 oz.
Gain in two years, 1 lb. 10 oz.

General Condition.—Emaciated to the last degree, extremely anæmic. Her abdomen was distended, the bony development showed marked rickets, but there were sixteen teeth.

Stools.—One constipated with enema, but formerly whenever sugar had been added to the food there was diarrhœa. This had occurred many times in the past two years.

Vomiting.—None.

Appetite.—Ravenous.

Sleep.—Good.

Temperature, 98.6° F.

Chief Complaint.—Emaciation, recurrent diarrhœa.

Previous Food.—Very intelligent bottle feedings of modified whole milk and skimmed milk mixtures throughout the first year and less intelligent persistence of these mixtures throughout the second year.

Treatment.—Food prescribed:

Dry milk	2, increased to 4 tablespoonfuls	Feed 5 oz. every 3 hours, 6 feedings in 24 hours at 6, 9, 12 A.M., 3, 6, 10 P.M.
Water	4 oz.	
Thick barley jelly	1 oz.	

Orange juice once a day.

July 30: Weight, 9 lb. 6 oz.
Gain, 4 oz.

General Condition.—The same.

Stools.—Normal.

Vomiting.—None.

Appetite.—Hungry.

Sleep.—Good.

Treatment.—Food prescribed:

Dry milk	5 tablespoonfuls	Feed 5 oz. every 3 hours, at 6, 9, 12 A.M., 3, 6, 10 P.M.
Water	3 oz.	
Barley jelly ...	2 oz.	

August 6: Weight, 10 lb. 2 oz.
Gain, 12 oz. in 7 days.

General Condition.—Improved.

Stools.—One normal.

Vomiting.—None.

Appetite.—Hungry.

Sleep.—Good.

Treatment.—Food prescribed:

Dry milk	6 tablespoonfuls	Feed 6 oz. every 3 hours, at 6, 9, 12 A.M., 3, 6, 10 P.M.
Water	3 oz.	
Barley jelly ...	3 oz.	

August 13: Weight, 11 lb. 2 oz.
Gain, 16 oz. in 7 days.

General Condition.—Improved.
Stools.—Two normal.
Vomiting.—None.
Appetite.—Satisfied.
Sleep.—Good.

Treatment.—Food prescribed:

Dry milk	7 tablespoonfuls	Feed 7 oz. every 3 hours, at 6, 9, 12 A.M., 3, 6, 10 P.M.
Water	3 oz.	
Barley jelly ...	4 oz.	

September 4: Weight, 13 lb. 2 oz.
Gain, 2 lb. in 21 days.

General Condition.—Much improved.
Stools.—Two normal.
Vomiting.—None.
Appetite.—Good.
Sleep.—Excellent.

On October 14th, three months later, she had more than doubled her weight, weighing eighteen pounds eight ounces, and was in splendid physical condition. In the meantime, vegetables and cereals had been added to the dry milk diet, as her powers of digestion increased.

The theoretical reasons for the ready digestibility of dry milk deserve consideration. First, and perhaps most important, is the change which takes place in the casein during the process of drying. The heat and the loss of water separates almost instantaneously the casein into minute particles which remain suspended in this finely divided state, when water is later added for feeding purposes. In the stomach these separate particles do not unite to form large masses or curds, such as are found when fresh cow's milk is acted upon by the gastric juice. Instead they become swollen in the stomach but remain separate particles, which are not only more easily attacked by the gastric juice, but

when they pass into the alkaline medium of the intestines, where the greater part of the digestion takes place, these fine particles are digested much more readily than the large curds of fresh cow's milk, or even the small curds of boiled milk.

The preparation of dry milk which the author has used contains a low fat, that is, 12 per cent. in the dry milk powder.[1] This is probably one reason that infants who have had an injury or indigestion due to fat, take care of it more easily than they do the ordinary milk mixtures. Besides that, dry milk contains a larger proportion of free fatty acid than does fresh cow's milk. These fatty acids react with the alkaline carbonates to form soaps and the soaps in turn form an emulsion, which assists in the digestion of the fats.

Besides the question of the proteins and the fats, the sugar of dry milk presents a very interesting problem. When first using dry milk, the author was surprised to find that dry milk and water alone proved to be a well-balanced feeding. In other words, the babies gained and prospered without any additional sugar, starch or other carbohydrates. We know that fresh cow's milk alone, without the addition of carbohydrates, is not a well-balanced ration, at any age, and it is almost impossible to make an infant gain continuously in weight without either the addition of sugar or starch. However, dry milk alone mixed with water, one part

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[1] Dryco Brand dry milk made by the Dry Milk Company, 15 Park Row, New York City.

APPROXIMATE ANALYSIS

	Per cent.
Fat	12
Lactose	44
Protein	34
Salts	7
Moisture	3
	100

1 oz. by weight = 127 calories.

8 level tablespoonfuls (levelled with a knife) = 1 oz. by weight.

1 level tablespoonful (levelled with knife) = 16 calories.

to eight by weight (one level tablespoonful to one ounce of water), gives a mixture containing about five and one-half per cent. lactose, one and one-half per cent. fat and a little over four per cent. protein. This high protein content makes it advisable to add sugar or gruels or both to the feedings of older infants after the digestive disturbances have been controlled, but usually not until four or five ounces (30 to 40 tablespoonfuls) of the dry milk product are consumed daily. With the larger quantities of dry milk the urine is apt to become ammoniacal and by increasing the calories with starch and sugar this excessive ammonia output in the urine can be avoided.

Synthetic or Reconstructed Milk.—It has long been the dream of various pediatrists, chemists and commercial houses, to reconstruct cow's milk so that it will have all the beneficial effects of breast milk. Whether this objective will ever be reached is not for us to say at the present time, but at least it may be said that perfection has not been achieved, else why are there so many of these foods on the market. As the new ones come along, the author has tried them out and found that each has a limited field of usefulness, although none is a universal food for infants nor a panacea for all digestive ills. S.M.A., Franklin Food, Recolac, Just Food, and the various powdered protein milks are all examples of reconstructed milk having cow's milk as the base of the food. Franklin Food is a good example of these foods and the following description of the manufacturing process is quoted from their literature.

They "take pure cow's milk and separate it into cream and skimmed milk. Pure butter fat is obtained from the cream and this is saved for use in reconstruction. By a special process, the excess calcium is removed from the skimmed milk, and the calcium of the calcium caseinate is replaced with sodium.

"We now have the ingredients with which to work—butter fat, vegetable oils and fats, cod liver oil, specially treated

skimmed milk, and milk sugar—in building an infant food.

"As cow's milk is somewhat lacking in sugar, the necessary amount of lactose is added to the specially prepared skimmed milk to bring it up to the sugar content of human milk.

"A proper amount of balanced fat is also needed and some of the butter fat originally taken out is therefore mixed with olive oil, cod liver oil, and cocoanut oil in the correct proportions. This combination of fats is then mixed in the water with the other ingredients. (Note that the addition of cod liver oil insures a liberal supply of Vitamin A.)

"The entire mixture of specially prepared skimmed milk, sugar, water, and fats is then placed in a machine called an emulsifier or 'homogenizer'. The action of this machine is to break up the fat particles and emulsify them in liquid until a milk-like consistency is obtained. This is done under extremely high pressure, which, when released, explodes the fat particles into minute pieces—literally tearing them to pieces.

"The resulting liquid is now dried to a powder by a special spray process which insures the retention of all the vitamins within the food. One tablespoonful of the powder when dissolved in two ounces of warm water gives the resulting mixture.

Franklin Infant Food

Fat	3.20 to 3.30
Milk sugar	6.40 to 6.50
Protein	1.45 to 1.55
Ash	0.30 to 0.40"

Merrell-Soule's Powdered Protein milk is an example of its kind and is made as follows:

"About 700 gallons of pasteurized skimmed milk are drawn into a sterilized and covered vat. A pure lactic acid culture is introduced and the milk is then kept at a controlled temperature until the hydrogenion concentration of approximately pH 4 is obtained.

"The whey is then drawn off in sufficient quantity to reduce the lactose percentage to 2 per cent. Fresh pastuerized cream is then added to the remaining curd to the extent of 2.25 per cent. of the total. This is then agitated thoroughly, the resulting composition being

Merrell-Soule Protein Milk Reliquified	per cent.	*Finkelstein Protein Milk for comparison*	per cent.
Protein	3.16	Protein	3.00
Butterfat	2.25	Butterfat	2.50
Lactose	2.00	Lactose	1.50
Ash	.42	Ash	.40
Free Lactic Acid	.25	Water	92.60
Water	91.92		
	100.00		100.00
Calories per ounce	12.6	Total Acidity	.35
Total Acidity	.48		
pH	3.8		

"This is then quickly subjected to the spray process of dehydration and the resultant powder is, in accordance with the analysis

In Powdered Form

	per cent.
Protein	38
Butterfat	27
Lactose	24
Ash	5
Free Lactic Acid	3
Moisture	3
	100
Total Acidity	5¾
Calories per ounce powder	143

Reliquified

"On mixing 3 ounces of powder by weight (10½ level packed tablespoons) in 1 quart of water, (i. e., 1 to 11 by weight) the resulting standard Protein Milk.

Each of these foods have given splendid results in individual cases and each has failed in certain cases but if any one of them were the universal food for infants, there would be no need for this book.

CHAPTER XXIV

MALT SOUP MIXTURES

Malt soup after Dr. Keller's formula consists of a malt extract which, becoming acid during the process of manufacture, is neutralized with four per cent. of potassium carbonate. To make the food, the malt extract is added to a mixture of wheat flour, milk and water and slowly brought to a boil.

Although many explanations have been offered for the efficacy of this food in certain cases, none is entirely satisfactory. Keller, himself, attributes the good results obtained to the large amount of carbohydrate, which he believes prevents putrefaction. The boiling of the milk, the addition of so large a quantity of salts (potassium carbonate), and, finally, its high food value (caloric value) undoubtedly all play a part. Whatever the theoretical explanation, it remains a fact that satisfactory results are obtained in a certain class of cases. The baby who under intelligent treatment has resisted every effort to make him gain continuously in weight will often, when put upon this food, make a gain of one-half pound the first week and thrive as long as the food is continued.

This food should be prepared in the following manner: To the proper amount of cold milk is added an amount of wheat flour which varies with the individual infant (Solution No. 1). To the proper amount of hot water is added the malt soup extract (Solution No. 2). Equal amounts in bulk of flour and malt soup must be used. The cold milk and flour (Solution No. 1) is put upon the stove and the water and malt extract (Solution No. 2) is poured into it. This mixture is then slowly brought to a boil, taking about twenty minutes in the process and stirring all the while. When it has come to an active boil the food is done.

The main point in the use of malt soup extract is that no set formula should be used. Keller's original receipt called for the same amount of milk, water, flour, and malt soup extract for every infant. When used in this way failure may be expected in a large number of cases, as it would not be possible to make one formula of any food that would apply to every infant. It is well to begin with one-third milk and two-thirds water for very small infants, while older infants may be started with half milk and half water. When first using the food begin with one level tablespoonful (levelled with a knife) or one-quarter ounce of flour (by weight) and one very scant tablespoonful of malt soup extract (one-half ounce by weight). The malt soup extract and flour should later be gradually increased in quantity, a tablespoonful at a time, as the infant needs more food and as its tolerance increases. Care should be taken to reckon the calories very accurately in order to make sure that overfeeding or underfeeding will not result. The author has seldom found it necessary to use more than one ounce by weight (four level tablespoonfuls) of flour or two ounces by weight (four scant tablespoonfuls) of malt soup extract.[1] After the proportion of milk and water has reached half and half, it should be kept at this strength for a month or two; that is, if a larger quantity of milk is needed to fulfil the infant's caloric requirements, an equal amount of water is used. Later, when the bulk becomes too great with half milk and half water, two-thirds milk or even three-quarters milk may be used.

Malt soup is fed at the same intervals and in the same quantities as any other food. It may be continuously used for a period of four or five months without causing anæmia, rickets, or other nutritional disturbances. The danger of scurvy is obviated by giving orange juice after the food has

[1] Two scant tablespoonfuls (one ounce by weight) of malt soup extract equal 90 calories.

Four level tablespoonfuls (one ounce by weight) of flour equal 100 calories.

been used for two months, or sooner in older infants. This is a detail which should not be omitted with this food or any other food that is boiled.

The stools are usually looser in consistency and more numerous when the malt soup feeding is used, but are otherwise normal in appearance, showing no signs of indigestion, and the infant makes a continuous gain in weight.

CASE LXXVIII

(Illustrating the use of malt soup feedings)

November 30: Age, 3½ months. Birth weight, 11 lb.
Present weight, 10 lb. 4 oz.
Loss, 12 oz.

General Condition.—Poorly nourished, pale, good musculature, no evidence of rickets. Needs 55 calories per pound per day.

Stools.—For two days, four watery, yellow stools with mucus but no curds.

Vomiting.—Considerable quantity after each feeding.

Appetite.—Ravenous.

Sleep.—Poor; crying night and day.

Temperature, 98° F.

Chief Complaint.—Repeated attacks of diarrhœa.

Previous Food and Feeding History.—This infant was first seen at one month of age. During the first month of life it had been underfed on the breast with a loss of nearly three pounds (if the birth weight given was correct). Artificial feeding was instituted with poor results. Whole milk and water was instituted with a gradual addition of sugar until this date (November 30). During this period of two and a half months since last seen there had been a gain of two pounds, but there had been four attacks of diarrhœa and vomiting. Each time the indigestion was overcome by stopping the sugar and giving milk and water boiled.

Treatment.—Food prescribed:

Milk	18 oz.	boiled	(360 cals.)	Divide into 7 bottles of 5+ oz. each. Feed every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water	18 oz.			
Sugar	0			

360 calories, or 33 calories per pound.

December 3 (3 days later): Weight, 10 lb. 4 oz.
No gain or loss.

General Condition.—The same.

Stools.—Constipated; *i.e.*, one with enema, yellow, hard, no mucus or curds.

Vomiting.—Very little.

Appetite.—Hungry.

Sleep.—Good.

Treatment.—Food prescribed:

Milk	20 oz.	boiled	400 cals.	Divide into 7 bottles. Feed 6— oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water	20 oz.	boiled		
Malt soup	½ oz.	(1 tbsp.)	45 cals.	
Flour	¼ oz.	(1 tbsp.)	25 cals.	
			470 cals., or 46– per pound.	

December 8 (5 days later): Weight, 10 lb. 9 oz.
Gain, 5 oz.

General Condition.—Improved.
Stools.—Two normal.
Vomiting.—None.
Appetite.—Ravenous.
Sleep.—Poor; cries before feedings from hunger.

Treatment.—Food prescribed:

Milk	20 oz.	boiled	400 cals.	Divide and feed as before.
Water	20 oz.	boiled		
Malt soup	1 oz.	(2 tbsp.)	90 cals.	
Flour	½ oz.	(2 tbsp.)	50 cals.	
			540 cals., or 54– cals. per pound.	

December 18 (10 days later): Weight, 11 lb. 2 oz.
Gain, 9 oz.

General Condition.—Improved, with gain in weight.
Stools.—Two normal.
Vomiting.—None.
Appetite.—Hungry.
Sleep.—Good.

Treatment.—Food prescribed:

Milk	20 oz.	boiled	400 cals.	Divide and feed as before.
Water	20 oz.	boiled		
Malt soup	1½ oz.	(3 tbsp.)	135 cals.	
Flour	¾ oz.	(3 tbsp.)	75 cals.	
			610 cals., or 55– calories per pound.	

This baby was fed upon malt soup for the next five months without any recurrence of the diarrhœa, and during that time gained nine pounds, nearly doubling its weight. (Weight, April 30, 19 pounds.) There were no evidences of rickets, anæmia or scurvy at any time. The juice of half an orange was given twice a day after the infant had received the malt soup for two months.

This was a difficult and discouraging feeding case until the malt soup was used. Although carefully fed with milk, water and sugar mixtures and doing nicely upon them for a week or two, without any apparent cause and often without any change of food at the time, the infant would suddenly develop diarrhœa and vomiting and cry day and night from indigestion. The sugar taken from the food, the digestive disturbances would stop. Added again, one teaspoonful at a time, up to an ounce in the twenty-four-hour amount, the infant would gain weight for a week or so, when the same thing would occur again. Different kinds of sugar were tried, and even milk in sufficient quantities without any sugar, but without avail. The malt soup was begun, followed by an immediate and continuous improvement. This is only one of a series of such cases.

It is sometimes advisable to start with far smaller quantities of malt soup and flour than given in the last case. A very small, emaciated infant who has had a great deal of diarrhœa and who has never done well on any food will not digest even a tablespoonful each of malt soup and flour at first. By beginning with a teaspoonful of each the tolerance is gradually increased for larger amounts.

Case LXXIX

(Illustrating the use of malt soup mixtures)

September 16: Age, 5 months: Birth weight, 8½ lb. (?)
Present weight, 6 lb. 10 oz.

General Condition.—Extremely emaciated, undersized, pale, skin rough, dry and scaly with eczematous spots. Mouth and tongue red. Umbilical hernia. Abdominal distention. Needs from 60 to 65 calories per pound per day.

Stools.—For two weeks, three or four green or yellow, loose, watery stools with mucus.

Vomiting.—A considerable quantity immediately after each feeding.

Appetite.—Good; takes all the food.

Sleep.—Restless.

Temperature, 97° F.

Chief Complaint.—Repeated attacks of diarrhœa; has never gained in weight.

Previous Food.—Breast-fed for three weeks. Was then fed plain milk, water and dextri-maltose mixtures in varying dilutions and quantities until two weeks ago.

Milk	14 oz.	boiled	Fed 4 oz. every 2½ hours, 7 or 8 feedings in 24 hours.
Water	17 oz.	boiled	
Dextri-maltose ...	1 oz.		

For the last two weeks has had a feeding made with two tablespoonfuls of barley flour and two teaspoonfuls of malt soup extract to one quart of water.

Treatment.—Food prescribed:

Milk	10 oz.	boiled	Divide into 10 feedings of 3 oz. each. Feed every 2 hours at 6, 8, 10, 12 A.M., 2, 4, 6, 8, 10 P.M., and 2 A.M.
Water	20 oz.	boiled	
Sugar	0 oz.		

Increase the milk one ounce each day, decreasing the water an equal amount until the proportion is half and half.

September 21 (5 days later): Weight, 6 lb. 10 oz.
No gain or loss.

General Condition.—As at the last visit.
Stools.—One smooth, homogeneous, normal stool.
Vomiting.—Practically none (a mouthful now and then).
Sleep.—Good at night, poor during the day.
Appetite.—Ravenous.
Temperature, 97° F.

Treatment.—Food prescribed:

Milk	16 oz.	boiled	Divide into 10 bottles. Feed 3 oz. every 2 hours, at 6, 8, 10, 12 A.M., 2, 4, 6, 8, 10 P.M., and 2 A.M.
Water	16 oz.	boiled	
Malt soup	1 teaspoonful (¼ oz.)		
Wheat flour ...	1 teaspoonful (⅛ oz.)		

Increase the malt soup and flour a teaspoonful each day.

September 24 (3 days later): Weight, 6 lb. 13 oz.
Gain, 3 oz.

General Condition.—Somewhat improved.
Stools.—One normal.
Vomiting.—None.
Sleep.—Good at night.
Appetite.—Hungry.
Temperature, 98° F.

Treatment.—Food prescribed:

Milk	16 oz.	boiled	320 cals.	Divide into 10 feedings and feed as before.
Water	16 oz.	boiled		
Malt soup ..	1 tablespoonful (½ oz.)		45 cals.	
Flour	1 tablespoonful (¼ oz.)		25 cals.	

390 cals., or 58– calories per pound.

October 7 (2 weeks later): Weight, 7 lb. 13 oz.
Gain, 1 lb.

General Condition—Improved.
Stools.—One normal.
Vomiting.—None.
Sleep.—Excellent.
Appetite.—Hungry.

Treatment.—Food prescribed:

Milk ....18 oz.	boiled	360 cals.	Divide into 7 bottles. Feed 4½ oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water .....18 oz.			
Malt soup.	2 tablespoonfuls (1 oz.)	90 cals.	
Flour	2 tablespoonfuls (½ oz.)	50 cals.	
		500 cals., or 62 calories per pound.	

October 21 (2 weeks later): Weight, 9 lb. 2 oz.
Gain, 1 lb. 5 oz.

General Condition.—Much improved.
Stools.—Two normal every day.
Vomiting.—None.
Sleep.—Good.
Appetite.—Satisfied.

Treatment.—Food prescribed:

Milk ....20 oz.	boiled	400 cals.	Divide into 7 bottles. Feed 5 oz. every 3 hours at 6, 9, 12 A.M., 3, 6, 10 P.M., and 2 A.M.
Water .....20 oz.			
Malt soup.	3 tablespoonfuls (1½ oz.)	135 cals.	
Flour	3 tablespoonfuls (¾ oz.)	75 cals.	
		610 cals., or 67 cals. per pound.	

CHAPTER XXV

BOTTLE WEANING AND FOOD FOR OLDER CHILDREN

Probably half the children between the ages of one and five years that come to the physician for treatment have the diet to account for their condition. During the second year when the children are changing from a period of infancy to that of young adult life, the subject of diet is of the utmost importance. Medical literature abounds in articles upon the feeding of infants during their first year, perhaps because the theories of infant feeding are varied and not as yet thoroughly settled, but little is said about the diet of children during their second and third years. During the early part of the second year, children, if allowed to do so, will either eat nothing at all in the way of solid food or will eat too much solid food if allowed to follow their own inclinations.

One of the chief errors which the author believes is commonly made is the practice of feeding too frequently during the second year. Many authorities recommend at least five or six meals at this age, and this is undoubtedly a great mistake. As soon as children have become old enough to take solid food they are often fed too frequently, and too frequent feedings cause digestive disturbances and loss of appetite, and, consequently, poor nutrition and anæmia result. They will take only part of the food offered and included in their dietaries, and they never seem to be hungry enough to take any new articles of food. This is a very unfortunate situation, because during the second year it is necessary to introduce into the dietary one new food after another, which from a practical standpoint is impossible when the child is not

hungry enough to eat. After the fourteenth month, the proper procedure is to cut down the number of meals to three with the addition of a 10 P.M. bottle. At eighteen months this 10 P.M. feeding should be omitted.

The older children should have their meals as regularly as infants have their feedings and not be allowed to eat between meals. No child should have set before it things which it may not eat. The usual family breakfast and luncheon are meals such as the children may be permitted to share, but they should never be allowed to eat with the family at dinner time. It is a good plan to give them their supper in the nursery at 5 or 5.30 o'clock so that they may be in bed during the family dinner hour.

One of the most frequent errors in diet is that of allowing too much milk during this period. Milk is a very good article of food for children and they should be allowed to have a certain amount of it each day. After eighteen months of age, one milk meal a day is enough. Too much milk has the same effect as too frequent feedings and is also the most frequent of all the causes of constipation. It is not uncommon to see a child of one and one-half years of age getting two quarts of milk in twenty-four hours. In older children it is often given to them with each meal; in younger children a drink of milk is given as a beverage whenever they become thirsty and they are allowed to partake of it instead of water. This is ruinous to their digestion.

The use of cereals is almost invariably overdone at this age. It is a common custom to give cereals twice a day, and some children get them oftener than this. Two cereal meals a day is enough at any age, but it is particularly important that no more than this should be given after the teeth have come. One reason why so many American children have teeth that are not well formed and decay early is that they are not given enough solid food upon which to chew. Unfortunately, the eating of mushy foods exclusively is the rule throughout

childhood. Children get into the habit of eating without masticating the food thoroughly, since such food can be swallowed without any chewing, and in this way, in part at least, the American habit of rapid eating is acquired. This is one of the reasons why all bread should be put into the oven and thoroughly dried until it is hard. It should then be chewed without the aid of liquids to wash it down.

New foods are being constantly introduced into the diet during the second year. It is advisable to begin with small quantities of a new food and gradually increase the amount. If a food seems to disagree with a child, it should not be eliminated from the diet but repeatedly tried in small quantities until it is properly assimilated, provided that the food is a proper one.

Getting the child to take the diet prescribed is one of the first difficulties that is encountered, as there are so many children who with great difficulty learn to eat solid food at the beginning of the weaning period. This is usually due to two mistakes. The first one of these is in not beginning to feed the baby with the spoon early enough. At six or seven months of age all children should learn to take water, milk or small amounts of cereal from the cup or spoon, so that they may learn to eat and thus acquire a taste for food. Some children always seem to have a distaste for any new article of food, and the matter of discipline enters into their taking the diet that is prescribed, since they must be taught to acquire a taste for each new food. There are, of course, those children who want to eat everything that the adult eats, and are allowed to do so, but a discussion of such cases need not be included here.

In laying out a diet for a child, it is never sufficient to say that it may take this and may not take that, but each meal should be planned. After inquiring into the habits of the family and the time of the child's sleeping periods, the time of day for the meals should be definitely stated. A very

general error in prescribing a diet both in sickness and in health is to say what the patient should not eat, without giving something to take the place of the food which has been interdicted.

Bottle Weaning at Eight to Ten Months of Age.—Weaning from the bottle should always be gradual if it is begun between the seventh and twelfth months. This is the proper age to begin to wean a well-nourished, normal infant. Babies who are very much undersized and who are poorly nourished or have had a stormy career so far as bottle feeding is concerned, often cannot be weaned until the beginning of the second year.

At seven months of age the strength of the mixture should be rapidly increased from two-thirds milk to three-fourths, then to four-fifths milk, so that, by the time the infant is about eight months of age, undiluted milk may be given in the bottle. In the meantime the sugar should be gradually decreased so that it is entirely omitted as soon as the undiluted milk is given.

While this is being accomplished, a cereal from the cup and spoon may be introduced into the diet and the infant encouraged to acquire a taste for it. At first enough will not be taken to make an entire feeding, so that it is necessary to finish this feeding with the bottle. The infant should be allowed to take all the cereal it will from the spoon and, after six or eight ounces are taken at one time, the bottle is omitted at this feeding. As soon as this is accomplished still another cereal meal may be given and the bottle omitted at that time. In the meantime, a stale piece of bread, zwieback or plain, unsweetened cracker may be given in the hand after any or all of the bottle feedings.

The cereal should be made as thick as an ordinary gruel, and, after it is cooked thoroughly, thinned down with milk. It should be salted to taste, but not sweetened. Infants often dislike the gritty taste of farina or cream of wheat, so it is

best to begin with barley, rice flour, arrowroot or strained oatmeal gruel. Later on, farina, cream of wheat, wheatena or oatmeal unstrained may be given and are valuable in helping the child to acquire a taste for different kinds of foods.

CASE LXXX

(Illustrating the weaning of a bottle-fed infant at 8 months of age)

May 24: Age, 8 months 2 weeks. Birth weight, 9 lb.
Present weight, 19 lb. 15 oz.

General Condition.—Fat, normal infant. Needs from 40 to 45 calories per pound per day.

Stools.—One or two normal a day.

Vomiting.—None.

Appetite.—Excellent.

Temperature, 98.6° F.

Previous Food:

Milk..........	32 oz.	640 cal.	Fed 8 ounces every 3 hours at 6,
Barley gruel..	16 oz.	100 cal.	9, 12 A.M., 3, 6, 10 P.M.
Dextri-maltose.	1½ oz.	180 cal.	

920 cal., or 45 cal. per lb.

For the last two weeks has been getting thick barley gruel, fed from the spoon just before the 12 M. bottle, and is now having 4 or 5 ounces of this gruel.

Treatment.—Food prescribed:

Milk	32 oz.	Divide into 5 bottles of 8 oz. each
Water	10 oz.	and feed at 6, 10 A.M., 2, 6, 10 P.M.
Dextri-maltose	1 oz.	

At 10 A.M. and 2 P.M. barley gruel, farina or strained oatmeal with milk upon it should be given in addition to the bottle.

June 7 (two weeks later): Weight, 20 lb. 6 oz.
Gain, 7 oz.

General Condition.—As at last visit.

Stools.—Two normal.

Vomiting.—None.

Appetite.—Takes bottle and gruel well.

Sleep.—Excellent.

Treatment.—Food prescribed:

Bottle Feedings.—Each day decrease the water one ounce, using the same amount of milk (one quart). Gradually decrease the dextrose maltose by

putting in one tablespoonful less every other day, until the baby is getting undiluted, unsweetened milk from cup or bottle.

Cereal.—Give a cereal feeding at first once a day, in one week twice a day, and (if the baby takes it well) the following week three times a day. A cereal should be cooked at least three hours, salted to taste and made as thick as you would eat it yourself, or thinner if the baby likes it that way. It should be eaten with full milk but no sugar upon it. Cereals should be varied from day to day with barley jelly, oatmeal, farina, cream of wheat, rice, wheatina and Ralston's food. At first barley jelly (made with either Robinson's or Brook's barley flour or pearl barley) is the best to give until the baby has become accustomed to taking a cereal, and later the cereals should be varied from day to day. One kind of cereal a day is sufficient and may be prepared in the morning for the whole day. If the bowels are constipated, wheatina, oatmeal and Ralston's food should be given more often than cream of wheat or farina. Baby may have all the cereal desired.

When a double boiler is used the cereal should be brought to a boil over the direct heat and then cooked in the double boiler for three hours. A fireless cooker is a most excellent means of cooking cereals for children, cooking the cereal in the cooker all night.

Breadstuffs.—Zwieback (either that which is bought or made at home by browning slices of bread hard and dry in the oven). Give dry in the hand, never between feedings, but immediately before or after a feeding, or it may be taken in the hand while baby is eating the cereal. Occasionally it may be given soaked in milk instead of cereal (if the baby likes it that way), but not customarily, because at this age baby needs to have some dry food. A graham cracker may be given immediately before or after a feeding if the bowels are constipated. If the bowels become too loose, stop the graham crackers. Three or four graham crackers should be enough in twenty-four hours, but no limit need be put on the quantity of zwieback or dry bread. No butter should be given.

Fruit.—Apple sauce (with very little if any sweetening) may be given once, twice or three times a day if the bowels remain constipated. Prunes should be cooked soft in very little water and no sugar. Before they are done allow the water to boil down so that there is a small amount of juice. Take out the seeds and press the prunes, skin and juice through a fine wire colander. Give only a few teaspoonfuls at first and gradually increase the amount. It is not harmful to give cooked fruit at the same meal with milk. Orange juice may be given one hour before one of the feedings once a day, using the juice of a whole orange.

Milk.—Encourage baby to drink milk from a cup, by pouring part of the bottle feeding into a cup, taking as much in this way as possible without making it extremely disagreeable. It is important that baby should learn to drink milk from a cup at this age, since babies who take milk well throughout childhood are usually strong and robust, provided they get the proper amount of other food. The bottle feedings may always be used to finish a meal if all the milk is not taken from the cup. One quart of milk should be taken each day throughout childhood, although the other food is equally important.

If any of the food suggested on this diet list is refused, a little should be given each day and the baby made to swallow at least a mouthful of it until the taste for it is acquired, provided it does not actually disagree or cause digestive disturbances.

DAY'S SCHEDULE (eventually)

6 A.M.:
- 8–10 ounces of milk from bottle.
- Zwieback, toast or graham cracker.

8 A.M.:
- The juice of a whole orange.

10 A.M.:
- Cereal.
- Milk from cup.
- Breadstuffs.
- Prunes.
- Follow with bottle if sufficient food is not taken from cup and spoon.

2 P.M.:
- Cereal.
- Milk from cup.
- Breadstuffs.
- Apple sauce if constipated.
- Bottle if necessary.

6 P.M.:
- Cereal.
- Milk from cup.
- Breadstuffs.
- Apple sauce if constipated.
- Bottle if necessary.

10 P.M.:
- 8–10 ounces of milk in bottle.

Diet at Twelve to Fourteen Months of Age.—At twelve months of age the child should be having three meals a day in addition to its two bottles. These meals should be as follows:

6 A.M.:
- 8 ounces of milk from bottle.
- Breadstuffs.

9 A.M.:
- Juice of a whole orange.

10 A.M.:
- Cereal.
- Milk from cup (8 ounces).

Breadstuffs.
Apple sauce or prunes.
Finish with bottle if sufficient food is not taken.

2 P.M.:
Give at first small baked potato with salt and a little milk if the baby likes it moistened. In a few days if it agrees with the baby a large baked potato may be given at this meal (and at the end of two weeks butter may be put on it instead of milk). In a few days begin a vegetable besides the potato, either carrots, spinach, green peas, string beans or asparagus tips. It is best to start with the spinach. A teaspoonful or two only is given at first and the amount gradually increased up to one or two tablespoonfuls. Vary vegetables from day to day.
Breadstuffs.
Milk from cup.
Apple sauce or prunes if constipated.

6 P.M.:
Cereal.
Milk from cup.
Breadstuffs.
Apple sauce, baked apple or prunes.
Follow by bottle if necessary.

10 P.M.:
8–10 ounces of milk in bottle.
One quart of milk a day should be taken.

Diet at Fourteen or Fifteen Months of Age.—At fifteen months of age an egg may be added to the diet. Before this time the child has become accustomed to the vegetables so that a fairly large quantity can now be taken. Vegetables contain iron which is much needed at this period.

Raw fruits such as scraped apple, pear, peach or an orange may be given between meals, particularly if there is a tendency toward constipation.

By fourteen or fifteen months of age, at most, the child's bottle feedings should be cut down to one, and three meals a day should be given. The feedings may be given in the following order:

6–7 A.M.:
Orange juice.

7–8 A.M. Breakfast:
Cereal (with milk but no sugar on it, cooked at least three hours): Vary

cereals each day with oatmeal, Quaker Oats, rice, cream of wheat, wheatina, farina, pettijohn, hominy, cornmeal mush and Ralston's food. No ready cooked cereals.
Milk from the cup (all baby will take).
Breadstuffs.

12–12.30 P.M. Dinner:
Vegetables: Baked potato with butter on it and one other vegetable each day, carrots, spinach, string beans, green peas or asparagus tips.
Egg: Coddled (to coddle an egg place it in cold water on the stove and allow the water to come to a boil rather slowly. When the water boils the egg is cooked. Cooked in this way the white is soft and jelly-like and the yolk somewhat set). Give only a few tablespoonfuls at first and gradually increase the quantity until at the end of a week or so one egg is taken every other day. The following week give one egg each day at this meal.
Milk from cup.
Breadstuffs.

5 P.M. Supper:
Milk from cup.
Breadstuffs.
Cooked fruit: Apple sauce, baked apple or prunes.

10 P.M.:
Milk: 8 ounces of milk in a bottle.

At least one quart of milk should be taken in twenty-four hours, but none between meals.

Diet at Two Years of Age.—At two years the child may have meat added to its diet, provided the teeth have properly erupted. The meals are now cut down to three a day and should be given as follows:

7–8 A.M. Breakfast:
Cereal (cooked at least two hours, with milk but no sugar on it): Vary cereals each day with oatmeal, Quaker Oats, Scotch oatmeal, cream of wheat, farina, wheatina, pettijohn, hominy, rice, cornmeal mush and Ralston's food. No ready-cooked cereals.
Milk.
Breadstuffs.
Egg: Coddled, should be given at breakfast only two or three times in a week.

12–12.30 P.M. Dinner:
Meat: A small piece of meat cut very fine. At first mash the meat in with the potato and give three or four times a week. A coddled egg should be substituted for the meat on the days when no egg has been given in the morning. The white meat of chicken, roast, boiled or broiled; lamb chop,

tenderloin steak, round steak shredded with a fork (all cooked rare). In a month or two when baby has become accustomed to these meats, roast beef, roast lamb and Hamburger steak may be given occasionally (all cooked rare, except chicken).

Vegetables: Baked potato and one other vegetable every day; vary with green peas, string beans, asparagus tips (all canned when out of season), carrots, spinach and tender young beets thoroughly mashed.

Breadstuffs.

Dessert: Apple sauce, baked apple, prunes (all cooked with the minimum amount of sugar), cut oranges and grape fruits.

5–5.30 P.M. Supper:

Milk: All the baby will take.

Breadstuffs.

Fruit: Apple sauce, baked apple, prunes, cut fruit such as oranges, grapefruit, scraped apple, pears, peaches, plums, apricots when in season. (It is not harmful to give fruit at the same meal with milk.)

Diet at Two and One-half to Three Years.—

Breakfast:

Cereal (with milk but no sugar, cooked at least two hours): Vary cereal each day. No ready-cooked cereals.

Milk.

Breadstuffs.

Egg: Soft boiled, coddled, poached, scrambled (scrambled in a saucepan over a low fire, with milk but no butter).

Bacon: Cut very thin like Beachnut bacon and cooked dry enough to eat with the fingers. Occasionally crumbled in the egg for variety's sake.

Dinner:

Meat: Vary meat each day, giving lamb chop, steak, Hamburger steak, roast beef, lamb or veal (roasts either cold or hot), all cooked rare. Chicken boiled, roast or broiled. No thickened gravies.

Fish (once a week): Baked or boiled.

Vegetables: Potatoes baked, boiled or mashed. At least one other vegetable each day, green peas, string beans, asparagus tips, small lima beans (all canned when out of season), beets, carrots, spinach, cooked celery, lettuce and raw celery but no other uncooked vegetables.

Breadstuffs.

Dessert: Apple sauce, baked apple, stewed rhubarb, prunes, cut oranges and grapefruit. Occasionally custard, junket, rice pudding, bread pudding and tapioca pudding or ice cream, all made without too much sweetening.

Supper:

Milk or cocoa (made with milk and very little sweetening).

Breadstuffs.

Creamed soups (made with milk but not much butter): Potato, dry pea or

bean, green pea or lima bean, asparagus, celery, corn (strained), tomato (very little tomato in it). Clear meat broths only occasionally, as they do not contain much nourishment.
Fruit: Apple sauce, baked apple or prunes. Raw fruit such as grapefruit, apples, pears, peaches, plums, apricots and berries in season when very ripe and sweet. If fruits are cooked very little sugar should be used.

This diet should not be altered materially until the school age is reached, when it may become necessary to change it somewhat to meet existing conditions. All really necessary foods are contained in this diet, and enough variety in the kinds of foods should be permitted so that it may not become distasteful through monotony. Meat should not be given more than once a day until the tenth or twelfth year. If it is at all possible, the hearty meal should be eaten in the middle of the day throughout childhood. If, after the beginning of the school age, this is not possible, the noon meal should be supplemented by a nourishing dessert, such as a custard or milk pudding.

Foods

Bread should always be given stale. White bread, whole wheat bread, graham bread, rye bread and bran biscuits may be given for the sake of variety. It is best put into the oven until it is brown and hard all the way through.

The more nourishing of the crackers may occasionally be given with the evening meal. Hard-tack, soda crackers, oatmeal crackers, graham crackers, egg biscuit, rice and arrowroot wafers, with an occasional sweetened cracker for dessert at supper, are allowable. Griddle cakes and hot breads are prohibited.

Cereals should be given but once a day after fifteen months of age. They should be well cooked, in milk or water, and should always be cooked one to three hours, according to the coarseness of the grain. Undercooked cereals are the source of much stomach disturbance. It is therefore well

to cook them the night before, as they are apt to be underdone when hastily cooked for breakfast. Wheatina, farina, rice, cream of wheat, Scotch and Irish oatmeal, rolled oats, cornmeal mush, hominy, samp, Ralston's food, pettijohn, are all excellent cereals. They should be eaten with milk but without sugar, for sugar at the morning meal usually destroys the appetite for the balance of the meal, which the child needs for its different food elements. The ready-cooked cereals may sometimes be given to older children, but their extensive use is not recommended.

Vegetables.—A frequent mistake is the omission of vegetables during the first half of the second year. From the theoretical standpoint this would seem to be wrong, since it is just at this age that the child needs iron and other salts which the vegetables contain. The child has been fed upon a milk diet throughout the first year, and milk is deficient in iron and other necessary mineral constituents. Theoretically, also, the infant is born with enough iron stored up, principally in the liver, to last him throughout the first year. From a practical standpoint, many children who are not given vegetables are anæmic, even though the diet has been most carefully regulated according to our American standards.

It has been the author's custom, therefore, to give potato once a day, and one other vegetable along with it, at the latest, by the beginning of the second year. It is necessary to cook these vegetables thoroughly so that they are soft, but vegetables must not be overcooked, as too much cooking destroys the vitamines. The water should never be thrown away since it contains iron and other desirable minerals. When boiling use a minimum amount of water at first, and when the vegetable is nearly done, take off the cover and allow the water to evaporate in the form of steam, leaving the minerals in the vegetable. At first mash them so that they contain no hard particles, as a child at this age is unable

to masticate well because of lack of teeth. Beginning with potatoes, which should be boiled, baked or mashed, other vegetables are gradually added. Peas, string beans, carrots, spinach, asparagus tips, beets, are all suitable vegetables for the child. Vegetables such as cabbage, cauliflower, onions, shelled beans, tomatoes, lettuce, celery, turnips or sweet potatoes should not be added to the diet until the third year.

Meat.—The first meat given should be rare beef scraped and mixed with the potato. The quantity may be gradually increased and, after a few weeks, other meats are added. Beef, roasted or broiled or chopped; lamb, roasted or broiled; veal, roasted or broiled; fish, boiled; and chicken, roasted, broiled or boiled, may be added to the diet. Pork, ham, sausage, liver, tripe, or thickened gravies should never be given to young children. Bacon cooked dry enough to eat with the fingers may be allowed after the middle of the second year. Boiled meats, with the exception of chicken, are not permitted at first.

Children who do not get the proper amount of protein in the diet are very apt to be large eaters, and, consequently, to overeat. Sometimes this overeating is of foods which are more difficult to digest than the meats. There seems to be a widespread tendency among the laity not to give meat during the second and, often, during the third years. There is also a tendency, after five years of age, to give meat more than once a day, which is almost as bad as the absence of it.

Eggs should be boiled or coddled. They are coddled by putting them into cold water and placing them on the stove until the water comes to a boil. After taking them off the stove, they are allowed to remain in the water for a minute or two. Cooked in this way the whites are soft and jelly-like instead of being hard and leathery; the yolks are slightly cooked, thus making them far more easily digested. Eggs are an essential item of the diet and if, at first, they are not

well taken each day, only a spoonful is given, increasing the amount as it becomes possible to do so. Fried eggs have no place in a child's dietary.

Clear Meat Soups are of little value. Thickened, they are often indigestible and the clear meat broths have very little nutrient value. The author omits broths from his diet lists for well children, except where a clear broth is given as a vehicle for the bread, vegetables and other foods. They are sometimes useful in stimulating the appetite.

It has long been understood that soups and broths have little nutrient value and contain only the extractives of meat. The child who takes a meal of soup gets very little nourishment except for the bread or whatever else is eaten with it. It is difficult to see, therefore, why a soup should be advised in every dietary for children. Usually they do not need a vehicle in which to take the bread or other carbohydrates, because most children eat these without urging.

Desserts may be given after the second year. Children whose appetites are poor should be allowed no desserts or sweets of any kind.

Sugar is an article of food which probably causes more digestive disturbances than any other one thing. We sometimes hear it argued that children have a craving for sweets and that this craving should be satisfied. Those who come in intimate contact with children soon learn that their cravings are not guides to their requirements. Sugar is a very concentrated form of nourishment, and its high caloric value takes away the appetite from other foods which are necessary. Often children who have their diet carefully regulated, particularly as they get older, get a certain amount of sweets in spite of any restriction that is put upon them. No matter how much we may say to the parents upon this subject, the sweets are always forthcoming. It is therefore best to limit sweet desserts to the noon meal, and, if possible, to prohibit them at all other times. The desserts may be given at the end of the second year and may consist of rice-

pudding, blanc-mange, gelatin puddings, farina, soft and hard custards, ice cream, sponge cake or lady fingers, dry or with whipped cream, angel cake or sweetened crackers. No other cakes or pastries are allowed until after the twelfth year. Special care should be given to prevent the use of sugar upon the cereals or fruits, and of candy between meals or at any other time.

Fruits.—The place of fruits in the child's diet is a very important one. They help to regulate the bowels, and offer the other elements of the food which are very necessary. Why it is that uncooked fruits are not allowed is difficult to understand, but such is the dictum of many pediatrists. Fruits are no more easily digested when cooked than when raw, especially since the custom of cooking them with sugar is a general one. From a practical standpoint, the author has long given uncooked fruits, even during the latter part of the first year, and has never found that the well child had any difficulty in digesting them, if they were given properly. They are indigestible if swallowed in hard pieces; therefore, until the end of the second year, before the teeth have all come and before the child has learned to masticate thoroughly, it is best to give them scraped or mashed. A ripe apple or pear when scraped with a spoon is allowed once or twice a day, or even more if the bowels require it. Children are usually fond of fruits served in this way, and they are more easily digested than prunes and other dried fruits which are often exclusively advised for constipation.

For variety's sake, however, fruits may be given either raw or cooked. Berries may be given after the third year.

Special Food for Sick Children.—Children when they are ill should not as a rule be forced to eat or made to eat things which they dislike. Neither should they be encouraged nor allowed to drink large quantities of milk at irregular intervals to quench the thirst during a fever, which is a common practice.

All food ought to be temporarily discontinued at the

beginning of any illness, and particularly so where there is fever. At this time clear broths and soups are an advantage, containing as they do only a minimum amount of nutriment which is not apt to overtax the digestion.

Beef, lamb and chicken broths are allowable and should be made in the following manner: Allow the meat, after it has been chopped, to stand in cold water for an hour or two, when it may be placed upon the stove and brought to a temperature of 160° F., but never to the boiling point. After simmering for two hours, it should be set away to cool so that the fat, which will then rise to the top and harden, can be removed.

When gruels, which are sometimes more easily digested than milk, are given, they should be made with water, a little salt being added, and they must be well cooked. They are best made in the following manner: Two or four tablespoonfuls of the flour (the amount varying with the age of the child) to one quart of water are used. First a thin paste should be made of the flour with a little cold water and, when this is free from lumps, it may be stirred into the proper amount of boiling, salted water. It may then be placed on the back of the stove and left to boil gently for a half hour, unless it is cooked in a double boiler, in which case it should boil at least one hour.

Barley, arrowroot, farina, cornstarch, wheat flour, cracker flour, rice flour, oatmeal, cornmeal, and browned flour gruels are all admirable for the sick child. Browned flour gruel is made by putting the flour into an oven and browning it all the way through, stirring it from time to time to prevent burning. An oatmeal or other coarse gruels should not be used in diarrhœa. Gruels may be dextrinized by adding a teaspoonful of Cereo [1] to them, after they are cooked and have cooled to a temperature a little above blood heat. This dextrinization changes the starch to dextrin

[1] Made by The Cereo Company, Tappan, N. Y.

and maltose and, during the process, thins even a thick gruel to a watery consistency.

For the sake of variety breaded pap and junket may be given to the sick child. The former consists of thin slices of white bread thoroughly browned in an oven, after which they are put into a saucepan with sufficient water to moisten them and brought to a boil. If there are no contra-indications this may be made with milk instead of water and slightly sweetened with cane sugar. Junket is made by adding a teaspoonful of essence of pepsin to one-half pint of fresh milk heated to blood temperature. After the flavoring and a little sugar (provided this is not prohibited in the diet) have been added, it should be poured into cups and allowed to remain undisturbed until it jellies. The nutritive value of the junket may be increased by adding a thoroughly beaten raw egg to the milk before it is heated. Junket tablets, which can be obtained from any druggist or grocer, may be used instead of the pepsin if so desired.

CHAPTER XXVI

THE PREMATURE INFANT—FOOD FOR TRAVELLING—WATER—LAVAGE—GAVAGE—IRRIGATING THE BOWELS

The Premature Infant

The premature infant rarely lives when born before the twenty-eighth week of intra-uterine life, but from then on each week added to its intra-uterine life will add to its chances of living. While it is not invariably the case, yet in most instances the larger and heavier the infant at birth, the greater will be its chances for life. Any infant weighing less than four pounds should be treated as though it were premature, since many of the organs are likely to be imperfectly developed, especially the lungs and the organs of digestion, and lack of strength in the muscles of deglutition makes it impossible for the infant to suckle properly.

Four factors determine success in keeping a premature infant alive and making it thrive: First, equitable temperature; second, little handling; third, proper nursing; and, fourth, the food.

Equitable Temperature.—There has been a great deal said both for and against incubators, some authorities believing that the incubator is a great source of danger and recommending the universal use of a basket, properly protected and with some suitable means of supplying artificial heat, such as an electric warming pad, or so arranged that the infant may be surrounded by hot-water bottles covered with a soft pad. Undoubtedly the incubator is the ideal method of maintaining even temperature, provided that there is a constant supply of fresh air which cannot possibly fail; that the air is not burned up by the heating process, and that it is

under the constant care of a nurse who is familiar with incubators and, therefore, knows how to run them.

I have never seen an incubator that will run itself without supervision. Many of the so-called automatic incubators are supposed to do so, especially those that are heated with incandescent lights which go out when the temperature gets above a certain point and are flashed on again when the temperature goes below a certain point. However, in spite of this ingenious contrivance, accidents occasionally happen, so, to insure safety, a nurse must watch every moment, both night and day.

A very excellent substitute for the incubator, and one which is far safer for the novice, or even the trained nurse who has not had experience with the more complicated incubators, is made in the following manner: the framework is made of two barrel hoops cut in halves. These are nailed together with longitudinal strips of wood to form a tent the size of a basinette or basket. It is then covered with heavy cotton cloth or a blanket to make the tent. Suspended from the top of the tent on the inside are electric light bulbs attached to a cord, which is of course connected to the current. Two to four bulbs may be used according to the temperature desired and also the season of the year. The tent may be left open at the head for ventilation or it may be so placed upon the baby that the head is outside of the tent, thus insuring plenty of fresh air.

The infant's temperature varies greatly with the changes in temperature of the air and also with the amount of food it receives and digests. A rise in body temperature to 101°, 102° F. or more may be due either to a too high temperature in the incubator, or to starvation or underfeeding of the infant, or imperfect development of the infant's heat centre, or to some intercurrent affection. The premature infant that runs a continuous subnormal temperature is doing no better than the one who has a temperature above normal. If

the temperature goes down to 96° F. or even 95° F. and does not rise above 97° F., life is at low ebb and the prognosis is not good. A temperature that has great variations, perhaps running from subnormal temperature to two or three degrees above the normal point, is also of bad import. This may mean that something is wrong with the external heating apparatus so that the temperature is not being kept even, or that the infant is not doing well from some other cause.

When the premature infant runs an even, normal temperature, a very much better prognosis can, of course, be made than is possible under the above-mentioned conditions. It is usually evident from a normal temperature of this sort that the feeding is well borne and that the external heat is properly managed.

Little Handling.—The premature infant should get a minimum amount of handling. Not only is handling hurtful in itself, but the less an infant is taken out of the warm surroundings, whether from an incubator or from a basket, the less chance there is for an inequitable temperature. When taken out to be fed or to have the diapers changed or for any other reason, the room should be very warm and free from draughts.

This infant should not get a bath in the usual sense of the word, but is rubbed instead with sweet oil once in two or three days, provided the temperature of the room is at least 80° F. It should not wear the usual clothing, but may have one garment, made of cotton wool laid between two layers of gauze, with sleeves long enough to come below the finger-tips and a skirt that can be pinned or sewed below the feet without interfering with the full extension of the legs. Nothing else should be worn except the diapers, which are best made of a thick pad of cotton and gauze and which are not to be pinned on, but simply laid in place so that they may be changed very quickly. The infant should be weighed in its clothing in order to prevent exposure. The clothes

may then be weighed and the amount deducted to get the actual weight.

Proper Nursing.—If good results are to be expected, a careful and conscientious nurse who is familiar with such cases is absolutely indispensable. A very small or weak infant should have two nurses, one for the day and one for the night, who have no other duties except those of watching and caring for the infant.

In one of the large amusement parks in this country there is a display of incubator infants, for view of which admission is charged, the mortality among whom has proved to be lower than that of any hospital in the country. This is principally due to the fact that they have trained attendants whose sole work, year after year, is taking care of premature infants. Their thorough schooling in this one branch of nursing has made them very competent. The average nurse has had very little experience with such infants and, if she can be made to realize this and can be taught, she will meet with greater success in her efforts.

The Food.—As in every other disease of infancy the most approved treatment of any sort is without avail unless the feedings are correct. There is no question but that the premature infant is greatly handicapped without breast milk. The author hardly feels warranted in giving a good prognosis for the very small premature infant unless the mother has breast milk or unless a wet nurse can be obtained. The vast majority of such infants have to take the breast milk from a medicine dropper for the first few weeks at least, as only the most vigorous are able to suckle the breast directly. Unfortunately, when the infant is not strong enough to suckle, the mother's breasts are apt to deteriorate, although pumping out the milk with a breast pump will tend to keep up the flow for a time. On the other hand, if a wet nurse is used her breast milk is kept up in quality and quantity by nursing her own infant. Very often, even when breast

milk is used, a sufficient quantity is not given. It is not possible to nourish any infant properly when only a dram or two of milk is given once in two hours or even if given every hour. If the premature infant cannot be made to take eight to ten ounces of breast milk in twenty-four hours after the first week of life, the prognosis is bad. The amount of this feeding may be very small at first, but should be gradually increased up to one ounce or an ounce and a half every two hours. It is not necessary to dilute the breast milk unless it is exceptionally rich in fats.

Breast milk can almost always be obtained if sufficient effort is made to do so. In the large cities there are wet-nurse agencies, either run by private individuals or public charities. At Bellevue Hospital, New York City, breast milk is sold for ten cents an ounce by mothers who have left the hospital. The mothers are obliged to come to the hospital to have the milk pumped out of the breasts in the presence of a nurse. In small towns it is often possible to get breast milk from some mother in the community who can spare a few ounces each day from her own infant. An energetic search in the community often results in locating enough breast milk to tide the premature infant over the critical period in the early weeks.

Where breast milk cannot be obtained, the next best food is dry milk (see page 325), and the author has had excellent results with it in feeding premature infants.

Begin for the first few days with one teaspoonful of dry milk to one ounce of water and give all of this that the infant will take every two hours, day and night. After three days, two teaspoonfuls to the ounce of water may be used. By the end of the first week the food may be used as strong as one level tablespoonful of dry milk to two ounces of water, even though the baby will not take the whole two ounces. From then on the general rule for feeding dry milk will apply. (See page 329.)

Food for Travelling

It is never advisable for an infant to travel, but it is sometimes unavoidable. At such a time the change of milk and the possibility of contamination make the food question a very difficult one, and one made all the more serious by the fact that the infant's digestive powers are often lowered with the usual excitement incident to travel.

An excellent way to carry the food is in a travelling ice-box with a wicker cover, in which good milk, carefully prepared, will last for forty-eight hours, if the ice is replenished. Where this is not practicable, the food, prepared as usual and boiled at least ten minutes before the sugar is added, should be put into an ordinary preserving jar and sealed at once. The jar must, of course, have been boiled previously, together with the cover and rubber, and ought to be still hot when the milk is poured into it. This should then be cooled at once and kept iced during the journey.

The Walker-Gordon laboratories supply a milk in any strength which is said to last over a journey of three weeks' duration, although it is not guaranteed for that length of time. This is a refinement which is not always possible for people who are too far away from a Walker-Gordon laboratory or who have not the means to afford such a luxury. However, where the facilities of these laboratories are available, this is a convenient way of supplying an infant with its proper food during a moderately long journey.

Dry milk is a very convenient food for travelling. It does not deteriorate and may be kept in a dry state over a long period of time. It is necessary to carry an alcohol lamp or a Sterno outfit in order to heat the water, and the food should be made immediately before each feeding. Occasionally it is advisable to begin the dry milk two or three days preceding the journey in order to see whether it is going to agree with the infant. For a journey involving only a few days or a week it is not necessary to add sugar or gruels, as dry milk in

itself is a fairly well-balanced food. For infants over two or three months of age, one tablespoonful of dry milk to one ounce of water is about the correct proportion. For further information concerning dry milk, see page 291.

Water

The routine practice of giving water to infants, the author believes to be very much overdone. Many begin the practice at birth, before the milk comes into the mother's breasts, by giving the infant sweetened water. Not only is such a procedure of no benefit to the new-born infant, but it is actually harmful in that it serves to prevent the taking of the breast after the milk has come.

After the early months of life, water from the spoon is useful as a means of teaching the infant to take nourishment in this way. If this habit has been acquired it will be helpful during the weaning period, because it accustoms the infant to the cup and spoon, so that at eight or ten months, when it is advisable to start giving food other than the breast, the infant will be able to take nourishment more easily.

Where the breast milk is sufficient and no other food is needed, an infant may be taught to take the bottle by giving water in it. Then if, at any time, an occasion arises necessitating the absence of the mother, or should she become suddenly ill, the infant will take its feedings in this way, for an infant who can take water from the bottle will have no difficulty in taking milk from it when necessary.

When it is taken into consideration that a bottle infant is getting a quart or a quart and a half of liquid nourishment (which is over 80 per cent. water) it is perfectly evident that water is not needed between feedings and the infant should not be forced to take large quantities of it. If the adult took as much in proportion to his weight, he would drink from five to eight gallons a day. The author mentions this particularly because the laity have the idea that water is

necessary and mothers are often greatly disturbed when it is refused.

Water never does any harm if the infant wants it except in cases of vomiting. It is a fact that certain breast-fed infants like water and take a good deal of it. Possibly this is because the breast milk, although it is sufficient in quality, is deficient in quantity. In this case it does no harm to give water, but it is best to be on guard lest this be a sign that the milk is not sufficient and water is greedily taken because of hunger. To determine this point one must watch the progress of the infant's nutrition by observing the weight and, if it is not gaining properly, bottle feedings should be added, instead of giving the water, until the breast milk can be improved.

In the case of a fever where there is no vomiting, plenty of cool water should be given in the bottle for the purpose of quenching the thirst so that the infant will not, when thirsty, take more food than it needs. The water may be given either cool or warm, but most infants, with a high temperature, prefer it cool.

Water with sugar in it should never be given under any circumstances. Mothers and nurses are so in the habit of giving water for all symptoms which may arise, such as hiccough, colic and crying, that the physician has to be on his guard lest it be done without his knowledge. A bottle-fed infant should receive all its sugar in the food itself and the breast-fed infant does not need any more sugar than the amount contained in the breast milk. Many an infant with vomiting, colic or loose stools will be found to be getting a large amount of sugar in the water, and, when this error is discovered and corrected, the symptoms may cease at once.

Lavage or Stomach Washing

The process of stomach washing in infants is a very simple one, and rather than being attended with any danger

is more often of decided benefit to the patient. It is no less effective in older children, but their struggles against having the tube inserted and the necessity of using a mouth gag often make the process difficult.

The prostration attending lavage is no greater than that of ordinary vomiting and the danger of misdirecting the tube into the larynx is practically *nil*.

The infant may be lying on its side or held in an upright position, its trunk slightly inclined forward and its arms and entire body encased in an improvised strait-jacket of towelling, rubber-sheeting or something of the sort.

The apparatus, which should first be sterilized, consists of a rubber catheter (American scale No. 12–16) connected by a piece of glass tubing to two feet of rubber tubing ending in a glass funnel (see illustration, page 210). While depressing the base of the tongue with the left forefinger, the catheter is quickly passed into the œsophagus with the right hand. At least ten inches of this tubing may be passed beyond the lips. The funnel is then held as far as possible above the infant's head to allow any gases in the stomach to pass off; then it is lowered to relieve the stomach of what liquid it may contain.

After these preliminaries, the funnel is again raised, and two to six ounces (depending upon the infant's age and capacity) of boiled water at a temperature of from 100° to 105° F. are allowed to flow into the stomach. By lowering the funnel this water will siphon out, bringing with it curds and other disturbing factors from the stomach. The process should be repeated until the water returns clear—which ordinarily will require from one to two pints. After the last siphoning, the tube is quickly withdrawn and the patient allowed to lie down.

The frequency of washing depends, naturally, upon the infant's condition, although it is rarely indicated oftener than once in twenty-four hours.

Gavage or Feeding by Tube

The same apparatus is used in gavage as in lavage, in fact each feeding should be preceded by washing the stomach in order that residue in the stomach may not interfere with the proper digestion of the food introduced. The chief difference is that the infant must always be in a recumbent position and is left so for some time after the process is complete (see illustration, page 240). The tube is quickly passed down the throat as in lavage and the proper amount of milk poured into the funnel. As soon as the food reaches the stomach, the tubing is pinched together to prevent the return of the liquid and consequent choking and gagging, and the catheter is quickly withdrawn.

This treatment has been effectively continued for weeks without injuring the patient in the least and has moreover proved the sole agent for maintaining life when other methods of feeding were impossible.

Irrigating the Bowels

The only apparatus necessary for bowel irrigations is a soft rubber catheter (American scale No. 16 to 18), a glass connecting tube, a fountain syringe or an enamel or glass irrigation jar, and a large douche pan (illustration, see page 170). Two quarts of a normal saline solution or plain tap water, warmed to a temperature of 100° F., should be used.

The legs of the infant are firmly clasped and held in the upright position and the water should be allowed to run from the tube to expel the air before the tube is inserted. After inserting the catheter into the rectum, the water is turned on in order to dilate the lower bowel so that the progress of the catheter, as it is inserted, may not be obstructed by the collapsed gut. It is a question, even with this precaution, whether the tube goes above the sigmoid flexure, as X-ray plates, taken of catheters after they have been inserted, show that they coil upon themselves instead of going

up into the descending colon, as was formerly supposed. For this reason the catheter should not be inserted more than six or eight inches at the most. When the bowel becomes filled with water, the water will run out around the tube, so that there is no danger of over-distending the colon by allowing too much water in it at any one time.

Bowel irrigations have been greatly overdone and harmful results are followed by their too frequent and unwarranted use. In severe cases of enteritis, irrigations, which are given every two or three hours over a prolonged period of time, only act as an irritant. The author has seen infants with diarrhœa, who have been receiving these irrigations for two or three weeks, in whom there is a prompt cessation of the frequent loose, mucous evacuations as soon as the irrigations were discontinued. The practice of removing mucus from the lower bowel is wrong if, as is now supposed, the mucus is thrown out by intestinal mucosa to protect the inflamed gut. Mucus is a wise provision of nature and should not be interfered with by irrigations or any other artificial means. Unfortunately, the presence of a large amount of mucus in the water after an irrigation is often wrongly interpreted as an indication for further irrigations.

At the beginning of an acute enteritis, one or two thorough irrigations are of great benefit, particularly if the bowels have not been evacuated thoroughly. An irrigation is also of benefit at the beginning of an attack of gastro-enteritis, where the vomiting is so excessive that it is impossible to administer a cathartic. It may be given to infants and children with a high temperature when a gastro-enteric cause is suspected and not confirmed by the appearance of the stools themselves. Outside of these indications, irrigations are better omitted, and are particularly contraindicated when used as a routine measure day after day.

CHAPTER XXVII

NORMAL DEVELOPMENT OF INFANTS

A PHYSICIAN must familiarize himself with the normal progress of an infant so that he may be able to distinguish between the infant doing well and the infant doing poorly. He will be asked many questions by anxious parents and he should be in a position to answer them correctly. There is only one standard, but there are variations within the normal.

Eyes.—For the first few days of life the eyes of the new-born infant should not be exposed to too strong a light. The pupils react to light from birth and within two weeks after birth a normal infant will follow light about the room and a little later will turn the head for that purpose. During the first three months there is not the proper coördination, and temporary strabismus results. This is often a source of great worry to the mother if it is not explained to her.

Ears.—For the first few days after birth the new-born infant is deaf. This is probably caused by the swelling of the mucous membranes and the absence of air from the middle ear. After four or five days, hearing is established and the child begins to be sensitive to noises and is easily disturbed by them. At the end of two or three months the head turns in the direction from which sound comes.

Touch.—The sense of touch is developed at birth, notably in the lips and tongue, indicated by the infant's readiness to take the breast and in the normal act of suckling. Temperature is also distinguished, as shown by the infant refusing its food when too hot or too cold. There is probably no localization of sensory impressions throughout the first year. The infant will cry from a pin prick, but apparently has no knowledge of where the pain comes from.

Taste.—The sense of taste is highly developed at birth and even the new-born infant can distinguish between sweet,

sour and bitter. An infant used to sweetened food will refuse it when it is unsweetened, showing that the slightest variation in the taste of the food is easily detected. The infant takes readily to sweet, and an infant will take very bitter substances when they are combined with a sweet syrup.

Smell.—It is doubtful how soon the sense of smell is developed. It is known, however, that this sense does not develop as soon as the other senses. The infant shows an ability to detect odors about the end of the first year.

Sitting and Walking.—The infant holds its head erect at four months of age, sits alone with no support at the back at six months, holds objects in its hands and puts them to the mouth between five and six months of age. At nine months it learns to creep if given an opportunity, and at one year should walk with support. The age of walking without support varies, depending upon surroundings. Some normal infants walk at ten months, others not until seventeen or eighteen months. The cause of delayed walking is usually malnutrition, rickets or any severe or prolonged illness.

Sitting alone and walking, besides many other functions, indicate the infant's mentality as well as his physical development. If an infant does not come up to the standard, this would naturally suggest either an arrestment of its mental powers or physical underdevelopment and an examination would be required.

Speech.—The development of speech varies widely in children. At the end of the first year the normal child usually says one or two words and, gradually, proper nouns are added to the vocabulary; then come the names of familiar objects and, at two years of age, these words are joined together with verbs and the infant learns to express its thoughts in simple language.

Height and Weight.—The normal infant should gain progressively in weight and in height. The increase in height should be about one inch each month for the first four months

and one-half inch each month after that until the end of the first year. The average infant is 20½ inches at birth and 27 inches at one year of age. The following table shows the average height as taken from a number of cases:

Age	Height
1 month	20½ inches
2 months	21 inches
3 months	22 inches
4 months	23 inches
5 months	23½ inches
6 months	24 inches
7 months	24½ inches
8 months	25 inches
9 months	25½ inches
10 months	26 inches
11 months	26½ inches
1 year	27 inches
2 years	31 inches
3 years	35 inches
4 years	37½ inches
5 years	40 inches
6 years	43 inches
7 years	45 inches
8 years	47 inches

The height and weight of an infant may be dependent upon race and climate and sometimes upon the size and physique of the parents. Every baby, moderately fed, should have a certain roundness characteristic of infancy. The following table shows the average weight as taken from a number of cases:

1 month	9 lbs.
2 months	10½ lbs.
3 months	12 lbs.
4 months	13½ lbs.
5 months	15 lbs.
6 months	16 lbs.
7 months	17 lbs.
8 months	18 lbs.
9 months	19 lbs.
10 months	20 lbs.
11 months	20½ lbs.
12 months	21 lbs.

Extremities.—The extremities should grow in proportion to the body length. The tips of the fingers should normally extend to the lower third of the femur. Both the legs and the arms should be straight, although a slight bowing of the legs is seen in early infancy. This should straighten out as the infant becomes older. An enlargement of the epiphyses is an indication of rickets.

Head.—The head should be round and symmetrical. The growth of the head is very rapid during the first year, the increase being about four inches in circumference. During the second year the increase is about one inch. From the second to the fifth year the growth is very much slower, being only about one and one-half inches for three years.

Fontanel.—The anterior fontanel normally closes at about the eighteenth month. It is widely open at birth and remains the same size throughout the first half of the first year; toward the end of the first year it should be open widely enough to admit the tip of the finger. It gradually becomes smaller until at about eighteen months the bones are united.

Teeth.—The two lower central incisors come first, at six or eight months; the four upper central incisors, two months later; within the next two months the two lower lateral incisors appear on either side of their fellows. Taking count, therefore, we have eight teeth at a year or a little later. At fourteen to sixteen months come the four double teeth, and at a year and a half, the canine, or eye and stomach teeth, come along to fill in the space that intervenes, making sixteen teeth in all at this age. At two or two and one-half years the last deciduous teeth are erupted, the four second molars, which complete the set of temporary teeth, twenty in all.

CHAPTER XXVIII

COW'S MILK

Cow's MILK, as the cheapest and most satisfactory substitute for the human product, assumes an importance worthy of a careful and an intelligent consideration. Within recent years the education of the public, together with the institution and authorization of milk commissions, has been largely instrumental in securing for the cities, particularly, a supply of milk that is beyond reproach and, except in rare instances, fit for use in infant feeding under proper precautions.

The free use of ice in this country has been a large factor in the successful and superior system of preserving fresh milk, and we are gradually learning that cleanliness is of most vital importance in the production and handling of a product so susceptible to contamination and bacterial infection.

Chemical Composition.—Simply stated, all cow's milk contains fat, carbohydrates, proteins, mineral matter, and water, varying in quantity and proportion with the time and frequency of milking, the individual peculiarities, the physical condition of the cow, and the breed. A good average milk contains 4 per cent. fat, 4.5 per cent. sugar, 3.5 per cent. protein, 0.75 per cent. salts, and the balance, or 87.75 per cent., water. The proteins are mainly casein and albumin and the chief salts, phosphoric acid, magnesium, potassium oxide, chlorine, and calcium and sodium oxides. Fresh milk is at first amphoteric or slightly acid, but soon gives a decided acid reaction, which increases as the milk ages. When either strongly acid or decidedly alkaline in its reaction, it should be rejected as indicating excessive bacterial growth in one case and the use of preservatives in the other. In

general, cow's milk differs from human milk in having a greater opacity, a stronger acid reaction, and more abundant, though less soluble, proteins. The fact that the proteins in cow's milk are about 0.5 per cent. albuminous and 3 per cent. casein (or curds), whereas human milk is 1.2 per cent. albumin and 0.5 per cent. casein, makes the latter more digestible in the infant's gastro-intestinal tract. The curds of human milk are loose and flocculent and quickly dissolved by the gastric juices, while those of cow's milk are hard and difficult of digestion. Human milk contains relatively few bacteria and nearly a third less inorganic salts, the latter being largely potassium and sodium, while cow's milk consists mainly of calcium and magnesium. The kind of sugar in both milks is practically the same, so far as chemical examination can determine, though human milk contains about 7 per cent., as against the 4 per cent. in average cow's milk. The fats are the most unstable element in both milks.

The most minute chemical knowledge of cow's milk, however, is not of much assistance in determining or affecting its digestibility in the infant's stomach. Cow's milk was intended for the calf, and in order to adapt it to the human infant's digestion such measures of modification or dilution as are mentioned elsewhere in this book must be instituted.

Sanitary Production

Cleanliness of the stable and of persons in any way connected with dairying is imperative. In New York cement construction is demanded, so that the buildings may be readily flushed and yet be impervious to moisture. An adequate supply of fresh air is required, and particular stress is laid upon satisfactory drainage and the removal of all excreta and rubbish. Stanchions, troughs, and milking stools must be of metal, and, while side walls and ceiling may be of wood, they must be frequently whitewashed or covered to prevent the accumulation of dust. Dust is recognized as

one of the chief sources of contamination, and its elimination does much toward increasing the purity of the milk. The fact that many farmers have been in the habit of feeding their stock and sweeping out the barns at milking time is one reason why it has been impossible to keep milk of a really superior quality uncontaminated.

No person actually infected with disease or coming in contact with a disease in another should be permitted in a dairy or cow barn. The hands should be carefully washed and *dried* before each milking—a precaution that is not always taken. Some light, easily-washed clothing should be worn during milking, preferably the white "dusters," which can readily be slipped on over the other clothing when milking is begun.

The care of the cow herself has been reduced to a science. In New York a frequent inspection of the physical condition of dairy cows is required. Where the milk of but one cow is used, she should be kept free from excitement, fright, or undue exercise that would alter her milk. For this reason, and because one cow's milk inevitably varies, it is highly advisable to use milk from a herd,—that is, a mixture of milks from several cows. In this way, too, the danger of transmitting the possible infection of one cow to the consumer is greatly minimized when her milk is combined and diluted with that of several other healthy animals.

It may be said here that the milk of the common or average breed of cow is preferable for ordinary purposes to that of the highly-bred animal whose milk is excessively rich. It is not only a fact that the milk of the Guernsey and Jersey cows contains a very high per cent. of fat (5 per cent. or over), but the fat globules themselves are large and therefore not as easily absorbed in the infant's enteric tract. The delicacy of the breed, too, renders them particularly prone to disease and fluctuating milk-composition.

The animals should be groomed daily as carefully as is

a horse, and just prior to milking should have the udder, tail, and belly wiped with a damp cloth and carefully dried.

The absolute cleanliness demanded in handling the milk after it leaves the cow is another necessary precaution. The foremilk, or that which is milked out first, should be discarded, as it invariably contains bacteria which have lodged in the damp milk-duct just inside the teat. The balance of the milk should be drawn off into sterile milk pails having an opening not exceeding eight inches in diameter (in order to minimize the amount of contamination that can get into the pail itself during the milking), and then put directly into bottles of the standard pint and quart size. Cooling the milk immediately and maintaining it at a temperature of 50° F. or less is the most important detail of its preservation. The modern dairy has a cooler in which the milk is placed immediately after milking. It is then bottled and packed in ice and kept at a low temperature until delivered to the consumer. Many dairies produce good milk, cool it immediately, and then allow it to be delivered without ice-packing. In this way, during its delivery, the temperature may be raised to 60° or even 70° F. In the same way the consumer often allows milk to stand at his door after an early morning delivery until the temperature has risen above 50° F., thus thwarting the purpose of careful production and delivery that the dealer intended.

A startling illustration of the results of poor cooling came to the author's attention recently in a summer resort. He was called to treat three children in one family who became suddenly ill with a severe infectious diarrhœa. It presently became known that nearly every child in the colony, which was supplied by the same milk dealer, was affected with the same disorder in varying degrees of severity. Upon investigation it was found that the milk, which came from another town, was left in the hot sun upon the station platform several hours before delivery, during which time the

bacteria had ample opportunity to multiply and the milk, of course, to outgrow its original purity and freshness.

Bacteria in Milk

The kind rather than the number of bacteria should be emphasized, though a count of 10,000 or less per cubic centimetre is considered desirably low.

The most dangerous bacteria, naturally, are the pathogenic variety, which are responsible for the transmission of tuberculosis and summer diarrhœa, typhoid, scarlet fever, and other epidemic diseases from the dairy or its neighborhood to the distant consumer.

According to Rosenau, "Milk is responsible for more sickness and deaths than perhaps all other foods combined—for several reasons: (1) bacteria grow well in milk . . . ; (2) of all foodstuffs, milk is the most difficult to obtain, handle, transport, and deliver in a clean, fresh, and satisfactory condition; (3) it is the most readily decomposable of all our foods; (4) milk is the only standard article of diet obtained from animal sources consumed in its raw state." To quote again, "Milk may . . . contain more bacteria than any other known substance; it frequently contains many more bacteria than are found in sewage" (Ref. Rosenau, "Preventive Medicine and Hygiene," pp. 494 and 510). Handling and exposure, naturally, do not reduce the number of microörganisms, and separator milk, or that which has been transferred from one receptacle to another, will be found to contain many more bacteria than "unmolested" milk.

At least 8 per cent. of cow's milk in this country is infected with tubercle bacilli, and 7 per cent. of the cases of human tuberculosis are directly attributable to a bovine source. "Pulmonary tuberculosis in man is practically never associated with the bovine bacillus. Bovine tuberculosis in man is usually a disease of the lymph-glands—the lymph-nodes of the cervical region and those of the abdomen

being especially attacked'' (Rosenau). For this reason, and because children drink so much milk, from one-third to one-half of the cases of tuberculosis in children are of the bovine type. Pulmonary tuberculosis, moreover, may be properly distinguished as a class disease, while the bovine infection attacks rich and poor alike, because of the universal use of milk.

As high as 10 per cent. of the cases of typhoid in this country may be traced to milk, and immediately upon the outbreak of an epidemic one of the first points of investigation is the milk supply, particularly if the trouble is limited to one neighborhood or along one milk route.

Scarlet fever from milk may inevitably be traced to some human source of infection. Carriers of the disease or patients themselves have frequently been found in dairies and shops, and in some cities where sterilization of bottles is not required contagion may be directly traced to the home of the disease. Not only the danger of the infected milk must be considered, but the high degree of contagion of the disease itself, once it is well established.

Diphtheria, though more rarely a milk-borne disease, is attributable to the same sources as scarlet fever.

Milk sickness and foot-and-mouth disease are strictly bovine infections in man, but are comparatively rare.

A more recent and serious infection, due almost entirely to cow's milk, traceable either to human sources or streptococci, is septic sore throat. In a notable epidemic in Boston, 1911, studied by Winslow, there were 20,000 cases and 48 deaths. In some of these epidemics the mortality is very high, and in all of them the morbidity is appalling from such a source as milk.

In cities that have no supervision of milk the infant mortality is almost overwhelming, whereas in the larger cities, where the milk supply is under careful supervision of the Board of Health or a medical milk commission, the

mortality is decreasing each year. New York City carries one of the lowest records for infant mortality in the United States. Although a high infant mortality might be expected under the conditions of overcrowding and poor hygienic surroundings, a comparatively excellent standard of health is reached, due, in part at least, to the careful supervision of the milk. In fact, in the large clinics in New York the complaint is being made by the internes and other assistants that they see too few cases of diarrhœa in the summer to give them sufficient experience in the subject, whereas in former years the clinics were overcrowded with such cases.

The "*natural*" bacteria of milk are, first and most numerous, the lactic-acid bacteria, almost immediately discernible in fresh milk and rapidly multiplying until, if unaltered, they succeed in souring it completely. Chapin has estimated that one bacterium, if left unhampered, would multiply 17,000,000 times in twenty-four hours. To maintain the sweetness of the milk, it is desirable to reduce the number of these bacteria and keep them from multiplying, although in action they have the advantage of preventing or inhibiting the growth and activity of the more dangerous protein-destroying bacteria. Reasons are also advanced for their value in the intestine.

The *decomposing* or *putrefactive* microörganisms, though more dangerous, exist in unpasteurized or unsterilized milk in a proportion not greater than 1 to 10 with the lactic-acid bacteria. Many intestinal disturbances, particularly in warm weather, are definitely attributable to them, especially if the milk has been previously altered by heating. An excessive number of putrefactive bacteria would either indicate extremely bad sanitary conditions in the production or handling of the milk or else a lapse of considerable time since the production, heating, or boiling of the milk.

There is a third variety of bacteria, classified mainly as the *streptococci,* which have apparently no effect upon the

milk and whose action upon the human organism has not been definitely determined, although it is known that some of the most severe illnesses of infancy are caused by them.

Beside the proper production of milk, there are two legitimate methods of reducing the bacterial count—pasteurizing and sterilizing—both of which have their advantages and drawbacks and neither of which obviate the necessity of keeping the milk cold or comparatively fresh.

Pasteurization requires a constant temperature of about 160° F. for at least twenty minutes, during which process all the non-spore-bearing bacteria are destroyed without radically altering the taste of the milk. If immediately cooled and used before it has a chance of being further contaminated, this is an eminently safe milk to use. However, if it is recontaminated, the powers of the milk itself to reduce the danger of the attacking bacteria by inhibition have been removed through heating, and, while the milk will not sour so readily, it becomes infected with a dangerous variety of bacteria. The process of pasteurization is a more or less difficult one to perform successfully and requires rather expensive equipment.

There is a brief treatment of milk, improperly called "commercial" pasteurization, which consists of a short exposure (not more than from thirty to sixty seconds) to a temperature of 160° F. This succeeds in killing some of the bacteria, but the milk should be immediately and hygienically bottled and cooled to avoid the dangers of recontamination. This method of pasteurization is not to be recommended.

Sterilization means simply boiling (212° F.) for varying lengths of time sufficient to destroy all microörganisms. It has the advantage of being simple, easy, and effective, but changes the taste of the milk markedly. It is advisable in very hot weather or when the milk has come from a decidedly questionable source, or in neighborhoods where the people are ignorant or have not the actual facilities for keeping raw

milk fresh. The value of boiled milk aside from the action of the heat upon the bacteria is discussed elsewhere.

It must be remembered that neither of these methods destroys the spore of the bacteria, which will survive almost indefinitely and germinate at the least rise of temperature. It is unfortunate that in this reinhabitation the putrefactive bacteria exceed the lactic organisms, so that, while the milk does not show the natural evidences of staleness, it is much more dangerous when improperly kept and cared for.

Adulteration of Milk

Under the careful supervision which milk now receives, the danger of adulteration is greatly reduced. The addition of cream to raise the percentage of the milk, though unusual, is not harmful. Neither is the addition of pure water, though this practice is no longer general under the specific standards of quality.

The following are the kinds of adulteration forbidden in New York as taken from the sanitary code of the City of New York:

First—Milk containing more than eighty-eight and one-half per centum of water or fluids.

Second—Milk containing less than eleven and one-half per centum of milk solids.

Third—Milk containing less than eight and one-half per centum of solids not fat.

Fourth—Milk from which any part of the cream has been removed.

Fifth—Milk containing less than three per centum of fats.

Sixth—Cream which contains less than eighteen per centum of butter fat.

Seventh—Milk, or cream from milk which has been drawn from animals within fifteen days before, or five days after parturition.

Eighth—Milk, or cream from milk which has been drawn from animals fed on distillery waste, or any substance in a state of putrefaction, or on any unwholesome food.

REGULATIONS GOVERNING THE GRADES AND DESIGNATION NEW

The following classifications apply to milk and cream. The regulations

Grades of milk or cream which may be sold in the city of New York	Definition	Tuberculin test and physical condition	Bacterial contents
GRADE A Milk or cream (Raw)	Grade A milk or cream (raw) is milk or cream produced and handled in accordance with the minimum requirements, rules and regulations as herein set forth.	1. Only such cows shall be admitted to the herd as have not reacted to a diagnostic injection of tuberculin and are in good physical condition. 2. All cows shall be tested annually with tuberculin and all reacting animals shall be excluded from the herd.	Grade A milk (raw) shall not contain more than 60,000 bacteria per c.c. and cream more than 300,000 bacteria per c.c. when delivered to the consumer or at any time prior to such delivery.
Milk or cream (Pasteurized)	Grade A milk or cream (pasteurized) is milk or cream handled and sold by dealers holding permits therefor from the Board of Health, and produced and handled in accordance with the requirements, rules and regulations as herein set forth.	No tuberculin test required, but cows must be healthy as disclosed by physical examination made annually.	Grade A milk (pasteurized) shall not contain more than 30,000 bacteria per c.c. and cream (pasteurized) more than 150,000 bacteria per c.c. when delivered to the consumer or at any time after pasteurization and prior to such delivery. No milk supply averaging more than 200,000 bacteria per c.c. shall be pasteurized for sale under this designation.
GRADE B Milk or cream (Pasteurized)	Grade B milk or cream (pasteurized) is milk or cream produced and handled in accordance with the minimum requirements, rules and regulations herein set forth and which has been pasteurized in accordance with the requirements and rules and regulations of the Department of Health for pasteurization.	No tuberculin test required, but cows must be healthy as disclosed by physical examination made annually.	No milk under this grade shall contain more than 100,000 bacteria per c.c. and no cream shall contain more than 500,000 bacteria per c.c. when delivered to the consumer or at any time after pasteurization and prior to such delivery. No milk supply averaging more than 1,500,000 bacteria per c.c. shall be pasteurized in this city for sale under this designation. No milk supply averaging more than 300,000 bacteria per c.c. shall be pasteurized outside of this city for sale under this designation.
GRADE C Milk or cream (Pasteurized) (For cooking and manufacturing purposes only).	Grade C milk or cream is milk or cream not conforming to the requirements of any of the subdivisions of Grade A or Grade B and which has been pasteurized according to the requirements and rules and regulations of the Board of Health or boiled for at least two (2) minutes.	No tuberculin test required, but cows must be healthy as disclosed by physical examination made annually.	No milk of this grade shall contain more than 300,000 bacteria per c.c. and no cream of this grade shall contain more than 1,500,000 bacteria per c.c. after pasteurization.

NOTE.—Sour milk, buttermilk, sour cream, kumyss, matzoon, zoolac and similar and shall be pasteurized before being put through the process of souring. Sour cream shall

No other words than those designated herein shall appear on the label of any container authorized under the State laws.

OF MILK AND CREAM WHICH MAY BE SOLD IN THE CITY OF YORK.

regarding bacterial content and time of delivery shall not apply to sour cream.

Necessary scores for dairies producing	Time of delivery	Bottling	Labeling	Pasteurization
Equip. 25 Meth. 50 Total 75	Shall be delivered within 36 hours after production.	Unless otherwise specified in the permit this milk or cream shall be delivered to the consumer only in bottles.	Outer caps of bottles shall be white and shall contain the words Grade A, Raw, in black letters in large type, and shall state the name and address of the dealer.	
Equip. 25 Meth. 43 Total 68	Shall be delivered within 36 hours after pasteurization.	Unless otherwise specified in the permit this milk or cream shall be delivered to the consumer only in bottles.	Outer caps of bottles shall be white and shall contain the words Grade A in black letters in large type, date and hours between which pasteurization was completed; place where pasteurization was performed; name of the person, firm or corporation offering for sale, selling or delivering same.	Only such milk or cream shall be regarded as pasteurized as has been subjected to a temperature averaging 145° Fahr. for not less than 30 minutes.
Equip. 20 Meth. 35 Total 55	Milk shall be delivered within 36 hours and cream within 48 hours after pasteurization.	May be delivered in cans or bottles.	Outer caps of bottles containing milk and tags affixed to cans containing milk or cream shall be white and marked "Grade B" in bright green letters in large type, date pasteurization was completed, place where pasteurization was performed, name of the person, firm or corporation offering for sale, selling or delivering same. Bottles containing cream shall be labeled with caps marked "Grade B" in bright green letters, in large type, and shall give the place and date of bottling and shall give the name of person, firm or corporation offering for sale, selling or delivering same.	Only such milk or cream shall be regarded as pasteurized as has been subjected to a temperature averaging 145° Fahr. for not less than 30 minutes.
Score 40	Shall be delivered within 48 hours after pasteurization.	May be delivered in cans only.	Tags affixed to cans shall be white and shall be marked in red with the words "Grade C" in large type and "for cooking" in plainly visible type, and cans shall have properly sealed metal collars, painted red on necks.	Only such milk or cream shall be regarded as pasteurized as has been subjected to a temperature averaging 145° Fahr. for not less than 30 minutes.

products shall not be made from any milk of a less grade than that designated for "Grade B" not contain a less percentage of fats than that designated for cream.
containing milk or cream or milk or cream products except the word "certified" when

Ninth—Milk, or cream from milk which has been drawn from cows kept in a crowded or unhealthy condition.

Tenth—Milk, or cream which has been diluted with water or any other fluid, or to which has been added, or into which has been introduced any foreign substance whatever.

Eleventh—Milk or cream, the temperature of which is higher than 50 degrees Fahrenheit, or which contains an excessive number of bacteria. This requirement includes "Grade C Milk" after pasteurization.

Twelfth—Milk or cream which is produced in violation of the rules and regulations adopted by the Board of Health.

The most dangerous adulteration is the use of preservatives, most commonly formaldehyde, borax, boric acid, and sodium bicarbonate. The danger lies not so much in the chemicals themselves, which, though harmful, are highly diluted, as in the original condition of the milk that would require such "doctoring." Their presence can usually be assured by the inability of the milk to sour or change normally with age.

Grades of Milk.—The sale of the offensive "grocery" milk or that which is doled out from cans in ofttimes dirty shops is being gradually, and in some places entirely, abolished. It is a grade of milk the cheapness of which prevents the care in production and transportation necessary for its successful preservation or initial cleanliness.

The best milk procurable is "certified," or, as the name implies, milk guaranteed to be of the highest uniform quality produced under the best conditions of health and cleanliness with the supervision of a medical milk commission.

Next in quality to certified milk is inspected milk, which in New York has three grades, A, B and C. On pages 310 and 311 are excerpts from the Rules and Regulations of the New York Board of Health illustrating this grading and the precautions taken to protect the public. No uninspected milk or a grade lower than C is procurable within the city.

RULES AND REGULATIONS FOR THE SALE OF DIPPED MILK AND CREAM IN STORES IN THE CITY OF NEW YORK

1. Milk or cream shall not be handled or sold in any room which is unduly crowded with goods, wares or merchandise.

2. Milk or cream shall not be dipped from cans stored in a room in which butter or cheese is manufactured.

3. Milk or cream must be stored in a cooling or refrigerating room, or ice chest, the construction of which has been approved by the Department of Health.

4. Milk or cream shall not be dipped from cans stored in a milk booth.

5. Milk shall be kept at a temperature of 50 degrees Fahrenheit, or below, at all times.

Equipment

1. Rooms in which milk or cream is handled or sold shall be well lighted.

2. The floors, walls, and ceilings shall be smooth and must be kept clean and sanitary.

3. All windows and doors shall be properly screened.

4. An adequate supply of hot water shall be provided for the washing of utensils.

5. A sufficient number of properly constructed ice tubs, or other adequate refrigerating facilities, for cans of milk or cream shall be provided.

6. All utensils used for dipping milk or cream shall be of the seamless sanitary type, heavily tinned.

Methods

1. No milk or cream shall be dipped from cans stored in any room in which rubbish or dirty material is allowed to accumulate, or in which there are offensive odors.

2. All cans or other receptacles used for milk or cream shall be cleansed thoroughly immediately upon emptying.

3. The cans from which milk or cream is dipped shall be packed in ice, and shall be kept covered as much as possible at all times.

4. The ice-tubs in which milk or cream is stored shall be painted inside and outside and shall be kept clean at all times.

5. A separate dipper shall be provided for each can from which the supply is being served, and such dipper shall remain in the can between dippings until all the milk in the can has been disposed of.

6. All dippers, measures, or other utensils used in the handling of milk, condensed milk, or cream must be kept clean while in use, and must be thoroughly cleaned with hot water and soda (sodium carbonate) and then with boiling water directly after each day's use.

7. All goods sold in milk stores must be either in unbroken packages, or must be so placed, protected, and handled that no dust or odors therefrom can injuriously affect the milk.

8. Dry sweeping and dusting in rooms in which milk or cream is dispensed is prohibited.

9. The tags on cans of milk or cream must be kept on file in the store for at least two months, for inspection by the Department of Health.

10. The attendants shall wear clean, washable outer clothing.

11. Only such persons shall be employed as are free from infectious disease which may be transmitted in the handling of milk.

CHAPTER XXIX

PROPRIETARY FOODS

The extensive use of the various proprietary foods throughout the country makes it necessary for the physician to know what each one contains and the proper way to use it.

Many of these foods are made up of ingredients which may be properly used with benefit to the individual infant—if the physician does not object to the use of a food that is advertised to the laity. However, these foods should be intelligently used and not merely according to a set of general formulas which the manufacturer prepares. In other words, the physician should be equipped with a sufficient understanding of infant feeding to construct each formula to suit the needs of the individual patient. If, for instance, a food is used that is composed of malt sugar, a sufficient knowledge of infant feeding would indicate the exact amount of milk and water necessary to be added to this food.

The remaining portion of this chapter will be devoted to a description of many of the foods that are used in this country, so that the physician may know what his patients are getting when they come to him having already been fed with a proprietary food, or he may direct the use of such foods if it is desired to continue them.

The "Allenburys'" Infants' Foods

Made by the Allen & Hanburys Company

There is a series of these foods, Nos. 1, 2 and 3.

Name.—The "Allenburys'" Milk Food No. 1 (for use from birth to three months of age).

Ingredients.—Dried milk and cream, and milk sugar

(66 + per cent.). Fresh cow's milk is modified to imitate the percentages of breast milk by adding cream and milk sugar. It is then evaporated *in vacuo* and sold in powder form.

How Used.—From one-quarter to one-half ounce of the powder is added to from three to four and a half ounces of water. Occasionally addition of 1 dram of separated cream is recommended.

Analysis of Food as Sold.—

	Per cent.
Moisture	1.82
Carbohydrates (soluble in water)	66.61
Carbohydrates (insoluble starch)	0.00
Soluble nitrogenous matter (calculated as albumin)	10.70
Milk fat	16.79
Soluble mineral matter	4.08

Analysis of Food as Prepared for Infant's Consumption.—

	Per cent.
Fat	3.33
Casein	1.12
Albumin	1.00
Carbohydrates	10.20
Mineral matters	0.67
Water	83.68

Caloric Value.—81.47 per ounce.

Price and Size of Package.— Small size, 12 ounces, retailing from 33 cents to 50 cents; large size, 24 ounces, varies from 75 cents to $1.

Name.—The "Allenburys'" Milk Food No. 2 (for use from three to six months of age).

Ingredients.—The same as No. 1, "with the addition of a small amount of maltose, dextrin, soluble phosphates, and albuminoids." The mixtures are stronger, the maltose and

dextrin being converted from crushed whole wheat with the addition of malt wort.

How Used.—Like No. 1, except that stronger mixtures are made.

Analysis of Food as Sold.—

	Per cent.
Moisture	2.24
Carbohydrates (soluble in water)	68.78
Carbohydrates (insoluble starch)	0.00
Soluble nitrogenous matter (calculated as albumin)	10.23
Milk fat	14.94
Soluble mineral matter	3.81

Caloric Value.—80.40.

Price and Size of Package.—Same as No. 1.

Name.—The "Allenburys'" Malted Food No. 3 (for use from six months upward).

Ingredients.—"Cooked wheaten flour (insoluble starch, 60 per cent.) and the active and nutritive constituents of pure malt." Cooked wheaten flour is acted upon by malt and partially dextrinized into dextrin and maltose.

How Used.—As a diluent for cow's milk.

Analysis of Food as Sold.—

	Per cent.
Moisture	3.00
Carbohydrates (soluble in water)	14.51
Carbohydrates (insoluble starch)	60.01
Soluble nitrogenous matter (calculated as albumin)	10.23
Milk fat	1.05
Soluble mineral matter	.60

Price and Size of Package.—Small size, 12 ounces, retailing from 24 cents to 30 cents; large size, 25 ounces, from 50 cents to 60 cents.

Babies' Food

Made by the Health Food Company

Ingredients.—Wheat and barley flour. The wheat and barley are sterilized and ground into a fine powder, 29 per cent. of the starch meanwhile being changed into dextrin by a process not described in the manufacturer's literature.

How Used.—The food is prepared for use with sweet milk and cream, granulated sugar and salt.

Analysis of Food as Sold.—

	Per cent.
Water	4.51
Fat	1.18
Proteins	15.31
Carbohydrates	78.10
Ash (phosphates)	.90

Caloric Value.—Not given.

Price and Size of Package.—Sold in fifty-cent cans which contain one pound.

Benger's Food

Made by Benger's Food, Ltd.

Ingredients.—Baked wheat flour, pancreatic extract. The wheat flour is baked *in vacuo* to thoroughly break up the starch granules, and pancreatic extract is added to it.

How Used.—The powder (in which form the food is sold) is made into a smooth paste with cold, fresh milk. To this boiling milk and water are added and the whole set aside to cool, during which time the pancreatic extract acts upon the starch, changing part of it into dextrin and maltose (92 per cent. dextrin and maltose in thirty minutes) and partially pancreatizing the milk. The process is completed by boiling the mixture.

Analysis of Food as Sold.—

Fat			.919
Carbohydrates	Dextrins and sugars	3.337	80.652
	Starch	77.023	
	Cellulose	.292	
Proteins			12.187
Mineral matter			.969
Moisture			5.273
			100.000

Analysis of Food as Prepared for Infants' Consumption (when made with equal parts of milk and water, and thirty minutes allowed for digestion).—

Fat			1.89
Sugars	Lactose	2.35	5.65
	Dextrins	2.00	
	Maltose	1.30	
Starch			.50
Protein			2.32
Mineral matter			.43
Total solids			10.79

Caloric Value (in powder form).—110.5 per ounce (average).

Price and Size of Package.—4 ounces, 25 cents; 12 ounces, 60 cents; $3\frac{1}{2}$ lbs., $1.75.

Carnrick's Lacto Preparata

Made by Reed and Carnrick

Ingredients.—Dried milk (from which the fatty acids are removed and replaced by cocoa butter), pancreatic extract, and milk sugar (63 per cent.). The fatty acids of the milk are removed and replaced with cocoa butter. The milk is then treated with fresh extract of pancreas, and, after

the proper amount of predigestion, pure milk sugar is added and the milk dried *in vacuo.*

How Used.—Add sufficient water to the powder to replace that taken out by evaporation. The food "requires no addition of milk or other food substances."

Analysis of Food as Sold.—

	Per cent.
Fats	12.35
Proteins	14.51
Soluble carbohydrates	63.68
Insoluble carbohydrates	00.00
Inorganic salts	3.66
Moisture	5.80

Analysis of Food as Prepared for Infant Consumption.—Not given.

Caloric Value.—21.78 per ounce.

Price and Size of Package.—½-pound package, 50 cents; 1-pound package, $1; 5-pound package, $4.

Hubbell's Prepared Wheat

Sold by Llewellyn's Drug Store, Philadelphia

Ingredients.—Wheat flour baked at a temperature of 230° F. for twelve hours.

How Used.—With milk according to formula.

Analysis of Food as Sold.—

	Per cent.
Proteins	11
Fat	1
Carbohydrates	74
Salts	4
Water	12

Caloric Value.—106 calories per avoirdupois ounce.

Price and Size of Package.—One size, 14 ounces, 50 cents.

Eskay's Food

Made by Smith, Kline & French Company

Ingredients.—Barley, wheat, oats, milk sugar (54 per cent.), a small quantity of whole egg and inorganic salts. The barley, wheat, and oats are thoroughly baked at a high temperature in order to rupture all the starch granules, and the sugar of milk and whole egg are used added.

How Used.—With fresh cow's milk or with top milks.

Analysis of Food as Prepared for Infants' Use.—

	Fat, Per cent.	Proteins, Per cent.	Milk sugar, Per cent.	Salts, Per cent.	Starch, Per cent.
Eskay's Food (regulation formula at six months with cow's milk)	3.00	2.50	5.00	0.50	1.25
Top milk formula at sixth month	4.00	1.75	4.75	0.50	1.25

Eskay's Food contains, as prepared by the various formulas, about 4 per cent. of Eskay's Food, or one and a third tablespoonfuls to the pint of mixture. The prepared food contains only 1.25 per cent. starch.

Analysis of Food as Sold (La Wall).—

	Per cent.
Fat	3.52
Proteins	6.70
Milk sugar	54.12
Starch (disrupted grains)	29.90
Dextrin, etc.	1.70
Fibre	1.30
Ash	.99
Moisture	1.70
	99.93

Caloric Value (dry).—120 calories per ounce.

Price and Size of Package.—3½-ounce, 25 cents; 8-ounce, 50 cents; 16-ounce, 75 cents; 68-ounce, $2.50.

Murdock's Liquid Food

Made by the Murdock Liquid Company

Ingredients.—"Raw preparation of beef, mutton, and fruits, preserved with 10 per cent. by volume of alcohol."

How Used.—In addition to the regular feeding, though not as a diluent.

Analysis of Food as Sold.—

	Per cent.
Albumin	11.10
Albuminoids	16.28

"Free from insoluble matter."

Caloric Value.—Not given.

Price and Size of Package.—5½ fluidounces, 55 cents; 11 fluidounces, $1.

Imperial Granum Food

Made by the Imperial Granum Company

Ingredients.—Wheat flour slightly dextrinized by a special process during which the raw starch is cooked (amount of dextrin and dextrose not given). Starch, 73.54 per cent.

How Used.—As an adjuvant to milk and water.

Analysis of Food as Sold.—

	Per cent.
Moisture	6.04
Ash	.49
Fat	.72
Carbohydrates	76.60
Total albuminoids	13.77

Analysis of Food as Prepared (with milk) for Infants' Consumption.—Not given, as it varies with formulas used.

Caloric Value.—About 117 calories per ounce.

Price and Size of Package.—Four sizes, from 4 to 72 ounces. Price varies somewhat, due to trade conditions in different localities.

Nestle's Food

Made by the Nestle's Food Company

Ingredients.—The food is composed of pure cow's milk, heated with cane sugar, condensed at a low temperature and mixed with ground wheaten biscuit in which most of the starch has previously been converted "by special process" into maltose and dextrin.

How Used.—Dissolved in water without other diluent.

Analysis of Food as Sold.—

	Per cent.
Fat	5.50
Proteins	14.34
Lactose	6.57
Cane sugar	25.00
Dextrin and maltose	27.36
Insoluble carbohydrates	15.39
Mineral matter	2.03
Moisture	3.81

Caloric Value.—115.084 calories per ounce.

Price and Size of Package.—6-ounce, 25 cents; 12-ounce, 50 cents; 72-ounce, $2.50.

Mellin's Food

Made by the Mellin's Food Company, Boston, Mass.

Ingredients.—Maltose and dextrins, with potassium bicarbonate. Made from wheat and malted barley, according to Liebig's formula. The process employed converts the starch of the grains into maltose and dextrins.

How Used.—With cow's milk, furnishing carbohydrates (maltose and dextrins), cereal proteins and salts.

Analysis of Food as Sold.—

		Per cent.
Fat		.16
Proteins		10.35
Maltose	58.88	
Dextrins	20.69	
Soluble carbohydrates		79.57
Salts		4.30*
Water		5.62
		100.00

Analyses of food mixtures prepared for infants' consumption vary with formula used.

One level tablespoonful of Mellin's Food added to a 16-ounce mixture increases the percentage of carbohydrates 1.10–, proteins 0.14–, salts 0.06.

One level tablespoonful of Mellin's Food added to a 20-ounce mixture increases the percentage of carbohydrates 0.91–, proteins 0.12–, salts 0.05.

Caloric Value.—

1 level tablespoonful	25 calories
1 ounce avoirdupois	105 calories

Price and Size of Package.—Marked price, 10 ounces, 75 cents; 5 ounces, 50 cents. Selling price in East, 10 ounces, 55 cents; 5 ounces, 35 cents.

Ridge's Food

Made by Ridge's Food Company

Ingredients.—Wheat, milk sugar, and bicarbonate of soda. The wheat is in digestible form through long cooking at high temperatures.

How Used.—With dilutions of milk and water according to formula.

* 1.8 per cent. derived from cereals and 2.5 per cent. potassium bicarbonate.

Analysis of Food as Sold.—

	Per cent.
Proteins	12.50
Fats	.26
Carbohydrates	81.47
Salts	.61
Water	5.16

Analysis of Food as Prepared for Infants' Consumption.— Variable, but given with each formula.

Price and Size of Package.—8-ounce, 25 cents; 16-ounce, 50 cents; 2-pound, \$1; 3½-pound, \$1.50.

Wyeth's Prepared Food

Made by John Wyeth and Brother

Ingredients.—Evaporated milk, malt, wheat, and barley, "prepared in such a way as to render the preparation easily assimilable."

How Used.—As a diluent with milk and water, warmed.

Analysis of Food as Sold.—

	Per cent.
Protein	14.25
Fat	3.25
Sugar and other carbohydrates	72.50
Mineral matter	4.0
Moisture	6.0

Analysis of Food as Prepared for Infants' Consumption.— Not given, varies according to formula.

Caloric Value.—About 110 calories per ounce.

Price and Size of Package.—8-ounce, 35 cents; 16-ounce, 65 cents; 6-pound, \$2.75.

Horlick's Malted Milk

Ingredients.—Full-cream milk combined with the extracts of malted barley and wheat, reduced by a special method and apparatus to a concentrated powder form which con-

tains 26 per cent. of milk solids. In the process of manufacture the starch of the grains is converted into maltose and dextrin, and the casein of the milk is so modified that tough, hard curds cannot be formed in the gastro-intestinal tract. It is soluble in water and requires no cooking to prepare it.

Analysis of Food as Sold.—

	Per cent.	
Fat	8.78	
Protein	16.35	
Dextrin	18.80	Total soluble carbohydrates, 67.95 per cent.
Lactose	10.65	
Maltose	38.50	
Inorganic salts	3.86	
Moisture	3.06	

Analysis of Food as Prepared for Infants' Consumption.—Not given, as it varies according to the different formulas.

Caloric Value.—121 calories per ounce.

Price and Size of Package.—Small size (7-ounce), 50 cents; large size (16-ounce), $1; family size (5-pound), $3.75.

Brooks's Baby Barley

Made by Brooks Barley Company

Ingredients.—Pure barley flour.

How Used.—With water.

Analysis of Food as Sold.—

	Per cent.
Fat	.84
Protein	7.93
Carbohydrates	81.41
Mineral matter	.57
Crude fibre	2.56
Moisture	6.69

Caloric Value.—Not given.

Price and Size of Package.—½-pound, 15 cents; 1-pound, 25 cents.

Sweetened Condensed Milk

Ingredients.—Cow's milk evaporated at a temperature of 212° F. to about one-quarter its original volume, with the addition of cane sugar—enough of which is added to make 50 per cent. sugar.

How Used.—With the addition of water.

Analysis of Food as Sold.—

	Per cent.
Fats	6.94
Proteins	8.43
Sugar	50.69
Salts	1.39
Water	31.30

Analysis of Food Prepared with Six Parts of Water.—

	Per cent.
Fats	.99
Proteins	1.2
Sugar	7.23
Salts	.17
Water	90.49

Unsweetened Condensed Milk

Ingredients.—Either whole or skimmed milk evaporated to about one-half or one-third its original volume, with the addition of cane or any other artificial sugar.

How Used.—Best used by adding equal parts of water, which solution is to be considered to be about the strength of cow's milk and may then be further modified by the addition of gruels, water, and sugar to suit the individual infant.

Analysis of Food as Sold.—

	Per cent.
Fat	8.34–10.10
Proteins	6. – 7.36
Sugar	10. –12.

LIST OF CASES

LIST OF TABLES

CALORIC VALUE OF MILK WITH DIFFERENT FAT PERCENTAGES

One ounce of milk containing fat	Caloric value	How obtained from 1 quart of milk set until cream all rises	
		Average milk, 4 per cent.	Rich milk, 5 per cent.
Per cent.			
12	40	Top 8 ounces..........	Top 11 ounces.
11	37.5	Top 10 ounces..........	Top 12 ounces.
10	35	Top 11 ounces..........	Top 13 ounces.
9	32.5	Top 13 ounces..........	Top 14 ounces.
8	30	Top 14 ounces..........	Top 16 ounces.
7	27.5	Top 16 ounces..........	Top 20 ounces.
6	25	Top 20 ounces..........	Top 24 ounces.
5	22.5	Top 24 ounces..........	All.
4	20	All...................	Remainder after skimming off 2 ounces.
3	17.5	Remainder after skimming off 2 ounces	Remainder after skimming off 3 ounces.
2	15	Remainder after skimming off 4 ounces	Remainder after skimming off 5 ounces.
1	12.5	Remainder after skimming off 8 ounces	Remainder after skimming off 8 ounces.
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